United States
Department of
Agriculture

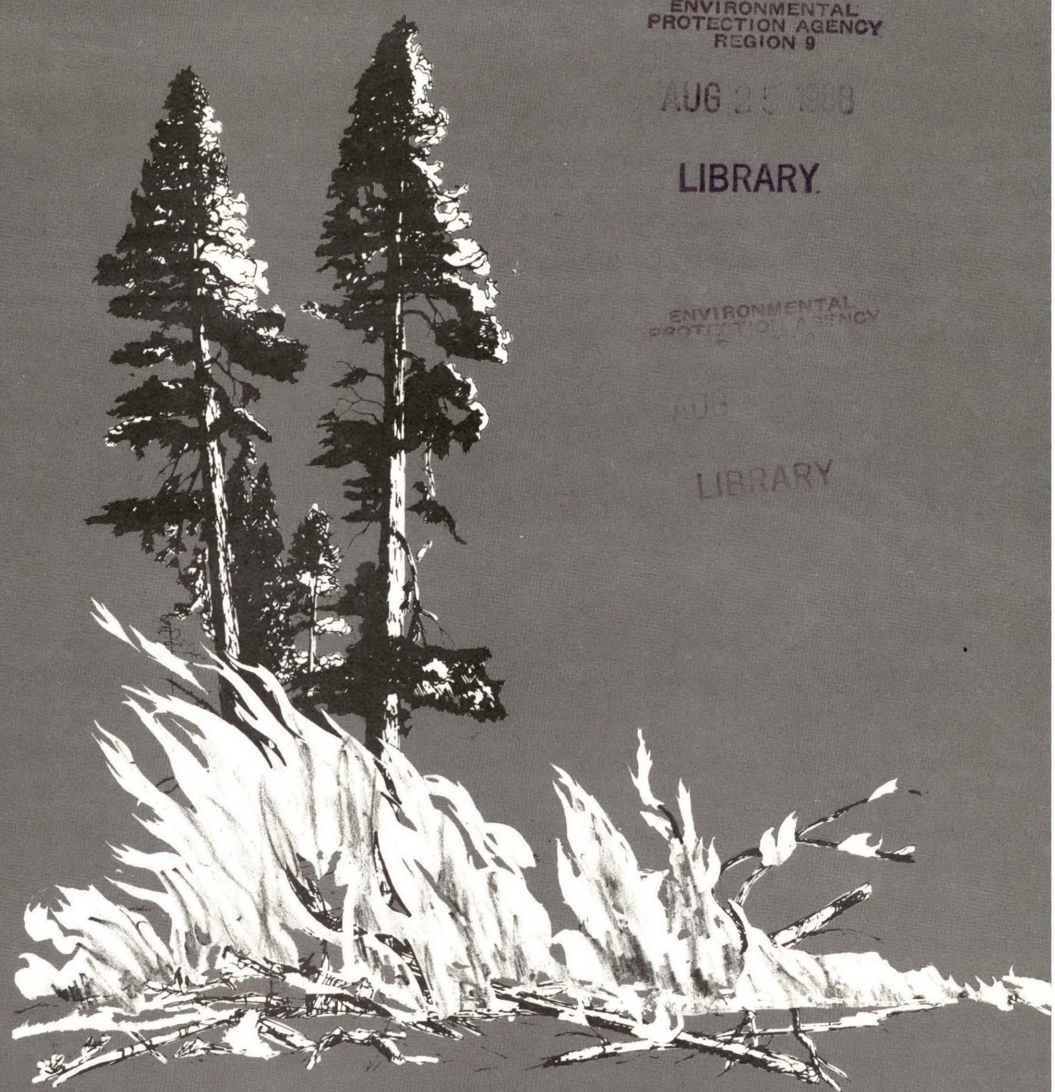
Forest
Service

Shasta-Trinity
National Forests

Final Environmental Impact Statement

South Fork Fire Recovery Salvage Project

Appendix



ENVIRONMENTAL
PROTECTION AGENCY

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CALIFORNIA SHASTA-TRINITY SOUTH FORK
FIRE RECOVERY APPENDIX.

APPENDIX A

APPENDIX A

United States
Department Of
Agriculture

Forest
Service

Hayfork RD

"QUALITY IN SERVICE AND RESOURCE MANAGEMENT"

DATE: 9 August 1988

REPLY TO: 2430

SUBJECT: Input for South Fork Trinity EIS

TO: Blaine Baker

CULTURAL RESOURCE INPUT FOR SOUTH FORK TRINITY RIVER EIS

AFFECTED ENVIRONMENT

Previous archaeological inspection within the boundaries of the EIS area of concern has been conducted for: Forest Service contract #53-9A28-0-3292 (Jensen, Peter M., "Archaeological Reconnaissance of the Silver, Maddox and Rattlesnake Parcels, Shasta-Trinity National Forest, Trinity County, California", December 1979); Forest Service contract #53-9A28-1-5051 (Baker, Suzanne, "Archaeological Reconnaissance On South Fork Mountain, Millerade & Sulphur-Blake Compartments, Trinity & Humboldt Counties, CA", February 1982); Forest Service ARR [Archaeological Reconnaissance Report] #05-14-113 (Mortensen, Milton G., "King Wallow Timber Sale", January 1978); ARR #05-14-359 (Sundahl, Elaine "Flume Timber Sale", August 1979); ARR #05-14-443 (Hitchcock, John R., "Friend Timber Sale", December 1980); Addendum #1 of ARR 05-14-443 for Friend Timber Sale (Dunn, Geofrey S., January 1984); Addendum #2 of ARR 05-14-443 for Jim's Friend Timber Sale (Hitchcock, John R., September 1985); ARR #05-14-454 (Mulholland, Jill, December 1980); ARR #05-14-494 (Mulholland, Jill, September 1980); ARR #05-14-615 (Hitchcock, John R., "Wallow-Fisher Timber Sale, Lower Plummer Helicopter Sale, and Wallow Sanitary Salvage Timber Sale", September 1985).

These inspections produced evidence for light utilization of the overall area during prehistoric times. Two properties (sites) with prehistoric components were recorded within the area of concern. One site is entirely prehistoric in nature, while the other site exhibits evidence of both prehistoric and historic utilization. These two sites do not exhibit evidence that would allow us to attribute their utilization to an ethnographically-known people.

Further specific archaeological inspection of lands in/near the area of concern applicable to this Environmental Impact Statement has produced one additional recorded cultural resource.

This property consists of both historic and prehistoric components. The historic component exhibits sporadic evidence of early 1900's utilization, possibly for mining purposes. The prehistoric component also exhibits evidence of sporadic utilization, without providing indicators that would allow us to attribute occupation to an ethnographically-known people.

The archaeological inspection for this EIS and it's results will be contained within ARR 05-14-728, "Fire Recovery Project".)

Ethnographically, the area is assigned to the Wintu (DuBois, Cora, "Wintu Ethnography", in University of California Publications in American Archaeology and Ethnology, V. 36, University of California Press, Berkeley, CA, 1940, pages 1 - 148; LaPena, Frank R., "Wintu", in Handbook of the North American Indians, Volume 8, California, Smithsonian Institution, Washington D.C., 1978, page 324).

MANAGEMENT REQUIREMENTS

The site's boundaries have been marked, the site's relationship to the treatment unit(s) will be shown on sale area maps, the site's proximity to harvesting areas will be discussed at timber sale pre-operations sale meetings, and the site will be excluded from all land-disturbing activities before/during/after all phases of the proposed undertaking.

ENVIRONMENTAL CONSEQUENCES

The first two properties referred to previously (above) are well over one aerial mile from the nearest land-disturbing activity associated with any/all of EIS Alternatives 2 through 6. There is no potential for any adverse effect to either of these two recorded cultural resources, should EIS Alternatives 2 through 6 be implemented as proposed.

The third property referred to previously (above) is located in a harvest unit (treatment unit in the case of Alternative 2) which was identified within all of the EIS action alternatives (2-6).

Since the site will be excluded and protected during land-disturbing activities associated with the various EIS alternative actions, there will be no effect to cultural resources as a result of implementation of any of proposed EIS Alternatives 2 through 6.

Since there would be no land-disturbing activities occurring under Alternative 1, there would be no effect to cultural resources from implementation of this alternative.

/s/ John R. Hitchcock
Hayfork-Yolla Bolla Zone Archaeologist

APPENDIX B

APPENDIX B

Treatment by Units

All cutting types were assigned a Suppression Difficulty Index (SDI). See Forest Service Handbook 5109.19. This is determined by fuel loading and then putting in an adjustment factor for slope. The following applies to Alternatives 3, 4, 5, and 6 before harvest.

Cutting Type	SDI Before Slope	SDI After Slope
Helicopter ITM	7.0	11.2
Helicopter CC	2.0	2.4
Cable CC	2.0	2.6
Cable ITM	7.0	9.1
Tractor ITM	10.0	10.0
Tractor CC	4.0	4.4

After harvest SDI is determined by the amount of slash that will be created. The assumption for all types of cuts are that there is no 0 to 3-inch fuels. The increase in slash will be the 3-inch plus material. By lopping all slash down to an 18-inch height and cutting the bole to an 8 foot length, all units will be acceptable. If we tractor pile 25 percent of the slash in the heavy cut tractor units, these units will be at an acceptable level.

To determine trees per acre and created slash the following assumptions were used.

Average DBH of Trees - 28 inches
Average Volume Per Tree - 1,700 board feet

30 MBFAC = 17.6 trees per acre = 13 tons per acre x .23% = 3 tons PAC 3" +
25 MBFAC = 14.7 trees per acre = 11.5 tons per ac. x .23% = 2.6 tons PAC 3"+
20 MBFAC = 11.7 trees per acre = 9.0 tons per ac. x .23% = 2.0 tons PAC 3" +
15 MBFAC = 8.8 trees per acre = 6.9 tons per ac. x .23% = 1.6 tons PAC 3" +
10 MBFAC = 5.8 trees per acre = 4.6 tons per ac. x .23% = 1.0 tons PAC 3" +

23 percent represents the weight of slash over 3 inches in diameter

Treatment By Units

Pile - 24 acres

FUEL TREATMENT - ALTERNATIVE # 3

LOP - 1,486 acres

Stand No.	Acres	Cutting Method	Volume Acre	Existing SDI	Remarks	After Harvest SDI	Treatment Method	Treatment Acres
1	62	H-ITM	3	11.2		11.2	LOP	62
2	82	H-ITM	2	11.2		11.2	LOP	82
3	165	H-ITM	3	11.2		11.2	LOP	165
4	9	H-CC	25	3.2		6.4	LOP	9
5	10	H-CC	15	3.2		3.2	LOP	10
7	33	C-CC	20	2.6		5.9	LOP	33
8	20	H-ITM	5	11.2		11.2	LOP	20
9	31	C-ITM	7	9.1		9.1	LOP	31
10	15	T-ITM	5	10.0		10.0	LOP	15
11	21	H-ITM	2	11.2		11.2	LOP	21
12	20	H-ITM	8	11.2		11.2	LOP	20
43	14	H-ITM	1	11.2		11.2	LOP	14
44	38	C-CC	35	2.6		5.2	LOP	38
45	17	T-CC	16	4.4		4.4	LOP	17
46	148	H-ITM	2	11.2		11.2	LOP	148
47	13	H-CC	5	3.2		3.2	LOP	13
48	20	H-CC	8	3.2		3.2	LOP	20
60	10	H-CC	22	3.2		5.2	LOP	10
61	13	H-CC	25	3.2		5.2	LOP	13
67	16	C-CC	28	2.6		5.2	LOP	16
68	37	C-CC	28	2.6		5.2	LOP	37
69	15	T-CC	44	4.4	Tractor Pile	4.4	LOP/PILE	11/4
70	13	C-CC	30	2.6		5.2	LOP	13
72	53	H-CC	12	3.2		3.2	LOP	53
73	44	H-CC	.3	3.2		3.2	LOP	49
74	20	T-CC	25	4.4	Intense Burn	4.4	LOP	20
77	372	H-ITM	3	11.2		11.2	LOP	372
79	14	H-CC	8	3.2		3.2	LOP	14
80	35	T-CC	25	4.4	Tractor Pile	4.4	LOP/PILE	26/9
83	40	T-CC	25	4.4	Tractor Pile	4.4	LOP/PILE	30/10
84	17	T-ITM	5	10.0		10.0	LOP	17
86	7	H-CC	15	3.2		3.2	LOP	7
87	6	H-ITM	1	11.2		11.2	LOP	6
88	11	T-ITM	5	10.0		10.0	LOP	11
90	10	C-CC	15	2.6		2.6	LOP	10
91	6	C-CC	20	2.6		2.6	LOP	6
92	9	C-CC	17	2.6		2.6	LOP	9
95	5	C-CC	15	4.4	Tractor Pile *	4.4	LOP/PILE	4/1
97	39	H-ITM	.5	11.2		11.2	LOP	39

Costs: Tractor Pile @ $127/acre
Burn Tractor Piles @ $70/acre
Lop to 18" max. ht. & 8' length @ $1.18/MBF

* Unit 95 can be tractor piled

Treatment By Units

Pile - 25 acres

FUEL TREATMENT - ALTERNATIVE # 4

LOP - 951 acres

Stand No.	Acres	Cutting Method	Volume Acre	Existing SDI	Remarks	After Harvest SDI	Treatment Method	Treatment Acres
67	16	C-CC	28	2.6		5.2	LOP	16
68	37	C-CC	28	2.6		5.2	LOP	37
69	15	T-CC	44	4.4	Tractor Pile	4.4	LOP/PILE	11/4
70	13	C-CC	30	2.6		5.2	LOP	13
71	3	T-CC	28	4.4	Tractor Pile	4.4	LOP/PILE	2/1
72	53	H-CC	12	3.2		3.2	LOP	53
73	44	C-CC	15	2.6		2.6	LOP	44
74	20	T-CC	25	4.4	Intense Burn	4.4	LOP	20
76	43	T-CC	25	4.4	Tractor Pile	4.4	LOP/PILE	32/11
77	627	H-ITM	3	11.2		11.2	LOP	627
78	31	H-CC	25	3.2		6.4	LOP	31
79	14	C-CC	8	2.6		2.6	LOP	14
80	35	T-CC	25	4.4	Tractor Pile	4.4	LOP/PILE	26/9
82	15	C-CC	20	2.6		5.2	LOP	15
96	10	C-CC	8	2.6		2.6	LOP	10

Costs: Tractor Pile @ $127/acre
Burn Tractor Piles @ $70/acre
Lop to 18" max. ht. & 8' length @ $1.18/MBF

Treatment By Units

Pile - 45 acres

FUEL TREATMENT - ALTERNATIVE # 5

LOP - 1,871 acres

Stand No.	Acres	Cutting Method	Volume Acre	Existing SDI	Remarks	After Harvest SDI	Treatment Method	Treatment Acres
2	82	H-ITM	2	11.2		11.2	LOP	82
3	165	H-ITM	3	11.2		11.2	LOP	165
4	9	H-CC	25	3.2		6.4	LOP	9
5	10	H-CC	15	3.2		3.2	LOP	10
7	33	C-CC	20	2.6		5.9	LOP	33
8	20	T-ITM	5	10.0		10.0	LOP	20
9	31	C-ITM	7	9.1		9.1	LOP	31
10	15	T-ITM	5	10.0		10.0	LOP	15
11	21	H-ITM	2	11.2		11.2	LOP	21
12	20	H-ITM	8	11.2		11.2	LOP	20
22	25	T-CC	15	4.4		4.4	LOP	25
24	26	T-CC	35	4.4	Tractor Pile	4.4	LOP/PILE	19/7
29	11	C-CC	25	2.6		5.2	LOP	11
30	9	T-CC	25	4.4	Tractor Pile	4.4	LOP/PILE	7/2
43	14	H-ITM	1	11.2		11.2	LOP	14
44	38	C-CC	35	2.6		2.6	LOP	38
45	17	T-CC	16	4.4	Light Loading	4.4	LOP	17
46	148	H-ITM	2	11.2		11.2	LOP	148
47	13	C-CC	5	2.6		2.6	LOP	13
48	20	H-CC	8	3.2		3.2	LOP	20
60	10	C-CC	22	2.6		5.2	LOP	10
61	13	C-CC	25	2.6		5.2	LOP	13
63	11	H-CC	20	3.2		6.4	LOP	11
64	29	H-CC	10	3.2		3.2	LOP	29
67	16	C-CC	28	2.6		5.2	LOP	16
68	37	C-CC	28	2.6		5.2	LOP	37
69	15	T-CC	44	4.4	Tractor Pile	4.4	LOP/PILE	11/4
70	13	C-CC	30	2.6		5.2	LOP	13
71	3	T-CC	28	4.4	Tractor Pile	4.4	LOP/PILE	2/1
72	53	H-CC	12	3.2		3.2	LOP	53
73	44	C-CC	15	2.6		2.6	LOP	44
74	20	T-CC	25	4.4	Intense Burn	4.4	LOP	20
76	43	T-CC	25	4.4	Tractor Pile	4.4	LOP/PILE	32/11
77	627	H-ITM	3	11.2		11.2	LOP	627
78	31	H-CC	25	3.2		6.4	LOP	31
79	14	C-CC	8	2.6		2.6	LOP	14
80	35	T-CC	25	4.4	Tractor Pile	4.4	LOP/PILE	26/9
82	15	C-CC	20	2.6		5.2	LOP	15
83	40	T-CC	25	4.4	Tractor Pile	4.4	LOP/PILE	30/10
84	17	T-ITM	5	10.0		10.0	LOP	17
86	7	H-CC	15	3.2		3.2	LOP	7
87	6	H-ITM	1	11.2		11.2	LOP	6
88	11	T-ITM	5	10.0		10.0	LOP	11
90	10	C-CC	15	2.6		2.6	LOP	10
91	6	C-CC	20	2.6		2.6	LOP	6

Stand No.	Acres	Cutting Method	Volume Acre	Existing SDI	Remarks	After Harvest SDI	Treatment Method	Treatment Acres
92	9	C-CC	17	2.6		2.6	LOP	9
95	5	C-CC	15	4.4	Tractor Pile *	4.4	LOP/PILE	4/1
96	10	C-CC	8	2.6		2.6	LOP	10
97	39	H-ITM	2	11.2		11.2	LOP	39

Costs: Tractor Pile @ $127/acre
Burn Tractor Piles @ $70/acre
Lop to 18" max. ht. & 8' length @ $1.18/MBF

* Unit 95 can be tractor piled

Treatment By Units

Pile - 45 acres

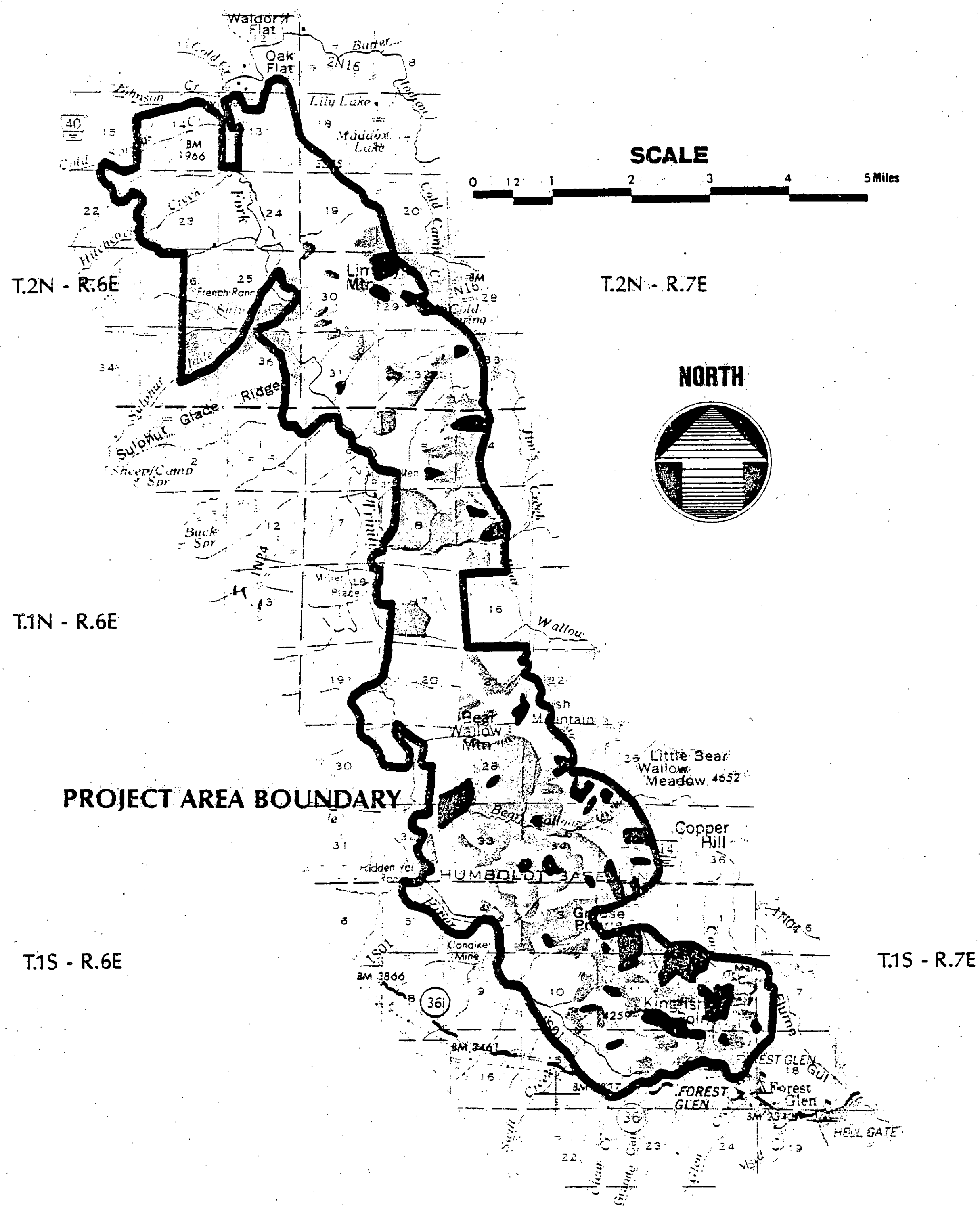
FUEL TREATMENT - ALTERNATIVE # 6

LOP - 2,965 acres

Stand No.	Acres	Cutting Method	Volume Acre	Existing SDI	Remarks	After Harvest SDI	Treatment Method	Treatment Acres
1	62	H-ITM	3	11.2		11.2	LOP	62
2	82	H-ITM	2	11.2		11.2	LOP	82
3	165	H-ITM	3	11.2		11.2	LOP	165
4	9	H-CC	25	3.2		6.4	LOP	9
5	10	H-CC	15	3.2		3.2	LOP	10
6	24	H-ITM	2	11.2		11.2	LOP	24
7	33	C-CC	20	2.6		5.9	LOP	33
8	20	T-ITM	5	10.0		10.0	LOP	20
9	31	T-ITM	7	10.0		10.0	LOP	31
10	15	T-ITM	5	10.0		10.0	LOP	15
11	21	H-ITM	2	11.2		11.2	LOP	21
12	20	H-ITM	8	11.2		11.2	LOP	20
13	44	H-ITM	1	11.2		11.2	LOP	44
14	24	C-CC	8	2.6		2.6	LOP	24
15	135	H-ITM	2	11.2		11.2	LOP	135
16	10	H-CC	10	3.2		3.2	LOP	10
17	7	H-ITM	2	11.2		11.2	LOP	7
18	5	H-CC	15	3.2		3.2	LOP	5
19	1	H-CC	33	3.2		6.4	LOP	1
20	5	H-CC	20	3.2		6.4	LOP	5
21	1	T-CC	30	4.4	Isolated Unit	4.4	LOP	1
22	25	T-CC	15	4.4		4.4	LOP	25
24	26	T-CC	35	4.4	Tractor Pile	4.4	LOP/PILE	19/7
25	14	H-ITM	8	11.2		11.2	LOP	14
26	11	H-CC	5	3.2		3.2	LOP	11
27	11	H-CC	15	3.2		3.2	LOP	11
29	11	C-CC	25	2.6		5.2	LOP	11
30	9	T-CC	25	4.4	Tractor Pile	4.4	LOP/PILE	7/2
31	140	H-ITM	2	11.2		11.2	LOP	140
32	11	H-ITM	5	11.2		11.2	LOP	11
33	5	H-ITM	10	11.2		11.2	LOP	5
34	5	C-CC	25	2.6		5.2	LOP	5
35	23	H-ITM	4	11.2		11.2	LOP	23
36	9	H-ITM	3	11.2		11.2	LOP	9
37	7	H-ITM	3	11.2		11.2	LOP	7
38	5	T-ITM	3	10.0		10.0	LOP	5
40	13	C-ITM	6	9.1		9.1	LOP	13
41	21	C-CC	20	2.6		6.4	LOP	21
43	14	H-ITM	1	11.2		11.2	LOP	14
44	38	C-CC	35	2.6		5.2	LOP	38
45	17	T-CC	16	4.4	Light Loading	4.4	LOP	17
46	148	H-ITM	2	11.2		11.2	LOP	148
47	13	C-CC	5	2.6		2.6	LOP	13
48	20	H-CC	8	3.2		3.2	LOP	20
49	180	H-ITM	2	11.2		11.2	LOP	180

Stand No.	Acres	Cutting Method	Volume Acre	Existing SDI	Remarks	After Harvest SDI	Treatment Method	Treatment Acres
50	29	T-ITM	3	10.0		10.0	LOP	29
51	10	C-CC	30	2.6		5.2	LOP	10
52	14	C-CC	25	2.6		5.2	LOP	14
54	30	H-ITM	1	11.2		11.2	LOP	30
55	29	H-ITM	1	11.2		11.2	LOP	29
56	15	C-ITM	8	9.1		9.1	LOP	15
57	19	T-ITM	5	10.0		10.0	LOP	19
58	56	H-ITM	2	11.2		11.2	LOP	56
60	10	C-CC	22	2.6		5.2	LOP	10
61	13	C-CC	25	2.6		5.2	LOP	13
62	34	H-ITM	3	11.2		11.2	LOP	34
63	11	H-CC	20	3.2		6.4	LOP	11
64	29	H-CC	10	3.2		3.2	LOP	29
65	36	H-ITM	5	11.2		11.2	LOP	36
66	17	H-ITM	8	11.2		11.2	LOP	17
67	16	C-CC	28	2.6		5.2	LOP	16
68	37	C-CC	28	2.6		5.2	LOP	37
69	15	T-CC	44	4.4	Tractor Pile	4.4	LOP/PILE	11/4
70	13	C-CC	30	2.6		5.2	LOP	13
71	3	T-CC	28	4.4	Tractor Pile	4.4	LOP/PILE	2/1
72	53	H-CC	12	3.2		3.2	LOP	53
73	44	C-CC	15	2.6		2.6	LOP	44
74	20	T-CC	25	4.4	Intense Burn	4.4	LOP	20
76	43	T-CC	25	4.4	Tractor Pile	4.4	LOP/PILE	32/11
77	627	H-ITM	3	11.2		11.2	LOP	627
78	31	H-CC	25	3.2		6.4	LOP	31
79	14	C-CC	8	2.6		2.6	LOP	14
80	35	T-CC	25	4.4	Tractor Pile	4.4	LOP/PILE	26/9
82	15	C-CC	20	2.6		5.2	LOP	15
83	40	T-CC	25	4.4	Tractor Pile	4.4	LOP/PILE	30/10
84	17	T-ITM	5	10.0		10.0	LOP	17
85	27	H-ITM	3	11.2		11.2	LOP	27
86	7	H-CC	15	3.2		3.2	LOP	7
87	6	H-ITM	1	11.2		11.2	LOP	6
88	11	T-ITM	5	10.0		10.0	LOP	11
90	10	C-CC	15	2.6		2.6	LOP	10
91	6	C-CC	20	2.6		2.6	LOP	6
92	9	C-CC	17	2.6		2.6	LOP	9
94	5	H-CC	15	3.2		3.2	LOP	5
95	5	T-CC	15	4.4	Tractor Pile	4.4	LOP/PILE	4/1
96	10	C-CC	8	2.6		2.6	LOP	10
97	39	H-ITM	2	11.2		11.2	LOP	39

Costs: Tractor Pile @ $127/acre
Burn Tractor Piles @ $70/acre
Lop to 18' max. ht. & 8' length @ $1.18/MBF



BURN INTENSITY
SOUTH FORK FIRE RECOVERY/SALVAGE PROJECT

LOW

MEDIUM

HIGH

APPENDIX C

APPENDIX C

SHASTA-TRINITY NATIONAL FORESTS
STREAMSIDE MANAGEMENT ZONE OBJECTIVES

SMZO 5:

Generalized Channel Description:
1. Nonsensitive to moderately sensitive ephemeral channel types

Water Quality Objectives:
1. Prevent significant channel disturbance.

Management Direction:
1. Designate as equipment exclusion zone.
2. Designate tractor crossings.
3. Suspend log to the extent possible while yarding over channel.

SMZO 4:

Generalized Channel Description:
1. Moderately sensitive to sensitive ephemeral channel types.

Water Quality Objective:
1. Prevent accelerated channel debris loading.
2. Prevent channel disturbance.

Management Direction:
1. Designate as equipment exclusion zone.
2. Designate tractor crossings.
3. Clear channel of debris.
4. Suspend log while yarding over channel.

SMZO 3:

Generalized Channel Description:
1. Sensitive ephemeral channel types, springs, glades and bogs.
2. Intermittent and perennial streams with dense hardwood and riparian vegetation.

Water Quality Objective:
1. Prevent accelerated channel debris loading.
2. Provide erosion "filter" adjacent to channel or riparian area.
3. Retain adequate riparian vegetation for shading and habitat needs.

Management Direction:
1. Equipment exclusion zone.
2. Designate tractor crossings.
3. Suspend log while yarding over channel.
4. Directional felling to minimize slash loads, aid vegetative retention and limit ground disturbance within the SMZ.
5. Retain all residual vegetation left after yarding
6. Exclude prescribed burning
7. Clear channel of debris

SMZO 2:

Generalized Channel Description:

1. Intermittent and perennial streams with sparse understory vegetation.
2. Occasionally springs, glades and bogs.
3. Potentially unstable channel margins.

Water Quality Objective:

1. Prevent accelerated channel debris loading.
2. Provide an undisturbed erosion "filter" adjacent to the stream.
3. Retain adequate riparian vegetation for shading and habitat needs.
4. Minimize windthrow hazard.
5. Provide conifer vegetation for maintenance of large organic debris sources.
6. Maintain sufficient live root mass in potentially unstable areas.

Management Direction:

1. Equipment exclusion Zone.
2. Designate tractor crossings.
3. Clear channel of debris.
4. Suspend log while yarding over SMZ.
5. Directional felling to help minimize slash loads, aid in vegetative retention and limit ground disturbance within the SMZ.
6. Retain noncommercial vegetation.
7. Partial retention of commercial vegetation defined by crown closure or minimum number of stems retained.
8. Exclude prescribed burning.

SMZO 1:

Generalized Channel Description:

1. Highly significant perennial streams, some intermittent streams, occasionally glades, and bogs.
2. Inner gorge channel reaches.

Water Quality Objectives:

1. Maintain existing riparian area in an undisturbed condition.
2. Maintain slope stability.

Management Direction:

1. Harvest exclusion zone.
2. Exclude prescribed burning.
3. "Tying off" skyline yarders through SMZ is acceptable unless otherwise specified, however the number of corridors should be of minimum number and width.
4. If yarding tail trees through SMZ, require full suspension over SMZ.
5. Clear channel of debris

APPENDIX C

Table 1. Existing cumulative impacts on fish habitat within four project area streams. Shasta-Trinity National Forests. 1988.

EVALUATION CRITERIA	LEVEL OF EXISTING IMPACTS											
	Cave Crk			**Lit. Bear Wallow**			**Plummer Crk**			South Fork		
	H	M	L	H	M	L	H	M	L	H	M	L
Pre-Fire												
Watershed												
Cumulative Effects			x			x		x			x	
Slope Stability			x			x		x			x	
Soil Erosion			x			x		x			x	
Fisheries												
Channel Stability			x			x		x			x	
Fish Habitat	x				x------	x		x		x---	x	
Riparian Habitat			x			x		x---	x	x---	x	
Shade Canopy			x			x		x---	x		x---	x
Fish Productivity	x					x		x		x---	x	
Invertebrates		x				x		x			x---	x
Fire Intensity												
Watershed	x				x				x			<x
Fisheries			x			x			x			<x
Post-Fire												
Watershed												
Cumulative Effects	x---	x			x			x			x	
Riparian Habitat		x			x			x				x
Sediment Delivery		x				x		x			x	
Instream Structure		x			x			x			-	
Fisheries												
Fish Mortality	NONE OBSERVED OR REPORTED											
Channel Stability		x				x		x			x	
Fish Habitat	x				x------	x		x		x---	x	
Riparian Habitat			x			x		x---	x	x---	x	
Shade Canopy			x			x		x---	x		x---	x
Fish Productivity	x					x		x		x---	x	
Invertebrates		x				x		x			x---	x

APPENDIX C

SOUTH FORK RECOVERY/SALVAGE ENVIRONMENTAL IMPACT STATEMENT

UNIT SPECIFIC MITIGATION MEASURES
WATERSHED AND FISHERIES
4-26, 1988

Unit 1 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)

Unit 2 (Alternatives 3, 5, and 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)

Unit 3 (Alternatives 3, 5, and 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)

Unit 4 (Alternatives 3, 5, and 6)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 5 (Alternatives 3, 5, and 6)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 6 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)

Unit 7 (Alternative 3, 5, and 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 8 (Alternative 3)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)

Unit 8 (Alternatives 5 and 6)

Harvest System and Silvicultural Prescription: Tractor Individual Tree Mark

Mitigation Measures:

Limited operating season (BMP 1-5)
50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)

Unit 9 (Alternatives 3 and 5)

Harvest System and Silvicultural Prescription: Cable Individual Tree Mark

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)

Unit 9 (Alternative 6)

Harvest System and Silvicultural Prescription: Tractor Individual Tree Mark

Mitigation Measures:

Limited operating season (BMP 1-5)
50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)

Unit 10 (Alternatives 3, 5, and 6)

Harvest System and Silvicultural Prescription: Tractor Individual Tree Mark

Mitigation Measures:

Limited operating season (BMP 1-5)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)

Unit 11 (Alternatives 3, 5, and 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)

Unit 12 (Alternatives 3, 5, and 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)

Unit 13 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)

Unit 14 (Alternative 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 15 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)

Unit 16 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 17 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)

Unit 18 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 19 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 20 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 21 (Alternative 6)

Harvest System and Silvicultural Prescription: Tractor Clearcut

Mitigation Measures:

Limited operating season (BMP 1-5)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 22 (Alternatives 5 and 6)

Harvest System and Silvicultural Prescription: Tractor Clearcut

Mitigation Measures:

Limited operating season (BMP 1-5)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 24 (Alternatives 5 and 6)

Harvest System and Silvicultural Prescription: Tractor Clearcut

Mitigation Measures:

Limited operating season (BMP 1-5)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 25 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)

Unit 26 (Alternative 5)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 27 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 29 (Alternatives 5 and 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 30 (Alternatives 5 and 6)

Harvest System and Silvicultural Prescription: Tractor Clearcut

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Limited operating season (BMP 1-5)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 31 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)

Unit 32 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)

Unit 33 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)

Unit 34 (Alternative 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 35 (Alternative 6)

Harvest System and Silvicultural Prescription: Cable Individual Tree Mark

Mitigation Measures:

50 foot SMZO-3 for all sensitive streamcourses within unit (BMP 1-8)
Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)

Unit 36 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)

Unit 37 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)

Unit 38 (Alternative 6)

Harvest System and Silvicultural Prescription: Tractor Individual Tree Mark

Mitigation Measures:

Limited operating season (BMP 1-5)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)

Unit 40 (Alternative 6)

Harvest System and Silvicultural Prescription: Cable Individual Tree Mark

Mitigation Measures:

Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)

Unit 41 (Alternative 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 43 (Alternatives 3, 5, and 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)

Unit 44 (Alternatives 3, 5, and 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

50 foot SMZO-3 for all sensitive streamcourses within unit (BMP 1-8)
Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)

Unit 45 (Alternatives 3, 5 and 6)

Harvest System and Silvicultural Prescription: Tractor Clearcut

Mitigation Measures:

Limited operating season (BMP 1-5)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)
Rip all skid trails (BMP 1-17)

Unit 46 (Alternatives 3, 5, and 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

100 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)

Unit 47 (Alternative 3)

Harvest system and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

100 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 47 (Alternatives 5 and 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

100 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 48 (Alternatives 3, 5, and 6)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

100 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 49 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)

Unit 50 (Alternative 6)

Harvest System and Silvicultural Prescription: Tractor Individual Tree Mark

Mitigation Measures:

Limited operating season (BMP 1-5)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)

Unit 51 (Alternative 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

100 foot SMZO-1 for sensitive channel along western boundary (BMP 1-8)
Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 52 (Alternative 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 54 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)

Unit 55 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)

Unit 56 (Alternative 6)

Harvest System and Silvicultural Prescription: Cable Individual Tree Mark

Mitigation Measures:

Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)

Unit 57 Alternative 6)

Harvest System and Silvicultural Prescription: Tractor Individual Tree Mark

Mitigation Measures:

Limited operating season (BMP 1-5)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)

Unit 58 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)

Unit 60 (Alternative 3)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 60 (Alternatives 5 and 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 61 (Alternative 3)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 61 (Alternatives 5 and 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 62 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)

Unit 63 (Alternatives 5 and 6)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 64 (Alternatives 5 and 6)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 65 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)

Unit 66 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

50 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)

Unit 67 (Alternatives 3, 4, 5, and 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)

Unit 68 (Alternative 3)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

100 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 68 (Alternatives 4, 5, and 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

100 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)

Unit 69 (Alternatives 3, 4, 5, and 6)

Harvest System and Silvicultural Prescription: Tractor Clearcut

Mitigation Measures:

Limited operating season (BMP 1-5)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)
Rip all skid trails (BMP 1-17)

Unit 70 (Alternative 3)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 70 (Alternatives 4, 5, and 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)

Unit 71 (Alternatives 4, 5, and 6)

Harvest System and Silvicultural Prescription: Tractor Clearcut

Mitigation Measures:

Limited operating season (BMP 1-5)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)
Rip all skid trails (BMP 1-17)

Unit 72 (Alternatives 3, 4, 5, and 6)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

100 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 73 (Alternative 3)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

100 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 73 (Alternatives 4, 5, and 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

100 foot SMZO-3 for all sensitive channels within unit (BMP 1-8)
Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)

Unit 74 (Alternatives 3, 4, 5, and 6)

Harvest System and Silvicultural Prescription: Tractor Clearcut

Mitigation Measures:

Limited operating season (BMP 1-5)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)
Rip all skid trails (BMP 1-17)

Unit 76 (Alternatives 4, 5, and 6)

Harvest System and Silvicultural Prescription: Tractor Clearcut

Mitigation Measures:

Limited operating season (BMP 1-5)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)
Rip all skid trails (BMP 1-17)

Unit 77 (Alternatives 3, 4, 5, and 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

100 foot SMZO-3 for designated channels within unit (BMP 1-8)
200 foot SMZO-1 for Cave Creek, Kingfisher Creek and designated perennial tributaries (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)

Unit 78 (Alternatives 4, 5, and 6)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

100 foot SMZO-3 for designated channels within unit (BMP 1-8)
200 foot SMZO-1 for Cave Creek and designated perennial tributaries (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 79 (Alternative 3)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 79 (Alternatives 4, 5, and 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)

Unit 80 (Alternatives 3, 4, 5, and 6)

Harvest System and Silvicultural Prescription: Tractor Clearcut

Mitigation Measures:

Limited operating season (BMP 1-5)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)
Rip all skid trails (BMP 1-17)

Unit 82 (Alternatives 4, 5, and 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

200 foot SMZO-1 for Kingfisher Creek and designated perennial tributaries (BMP 1-8)
Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)

Unit 83 (Alternatives 3, 5, and 6)

Harvest System and Silvicultural Prescription: Tractor Clearcut

Mitigation Measures:

Limited operating season (BMP 1-5)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 84 (Alternative 3)

Harvest System and Silvicultural Prescription: Cable Individual Tree Mark

Mitigation Measures:

Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)

Unit 84 (Alternatives 5 and 6)

Harvest System and Silvicultural Prescription: Tractor Individual Tree Mark

Mitigation Measures:

Limited operating season (BMP 1-5)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)

Unit 85 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

100 foot SMZO-3 for designated channels within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)

Unit 86 (Alternative 3, 5, and 6)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 87 (Alternatives 3, 5, and 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)

Unit 88 (Alternatives 3, 5, and 6)

Harvest System and Silvicultural Prescription: Tractor Individual Tree Mark

Mitigation Measures:

Limited operating season (BMP 1-5)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)
Rip all skid trails (BMP 1-17)

Unit 90 (Alternatives 3, 5, and 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)

Unit 91 (Alternatives 3, 5, and 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

100 foot SMZO-3 for designated channels within unit (BMP 1-8)
Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)

Unit 92 (Alternatives 3, 5, and 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Maintain 70 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 94 (Alternative 6)

Harvest System and Silvicultural Prescription: Helicopter Clearcut

Mitigation Measures:

Lop and scatter logging slash (BMP 1-14)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 95 (Alternatives 3 and 5)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 95 (Alternative 6)

Harvest System and Silvicultural Prescription: Tractor Clearcut

Mitigation Measures:

Limited operating season (BMP 1-5)
Prelocate skid trails (BMP 1-10)
Spread slash on skid trails (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Waterbar skid trails (BMP 1-17)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

Unit 96 (Alternatives 4, 5 and 6)

Harvest System and Silvicultural Prescription: Cable Clearcut

Mitigation Measures:

Waterbar cableways (BMP 1-14)
Lop and scatter logging slash on cableways (BMP 1-14)
Ditch, slope, and scarify landings (BMP 1-16)
Maintain 40 percent or greater organic ground cover following site preparation (BMP 1-14)

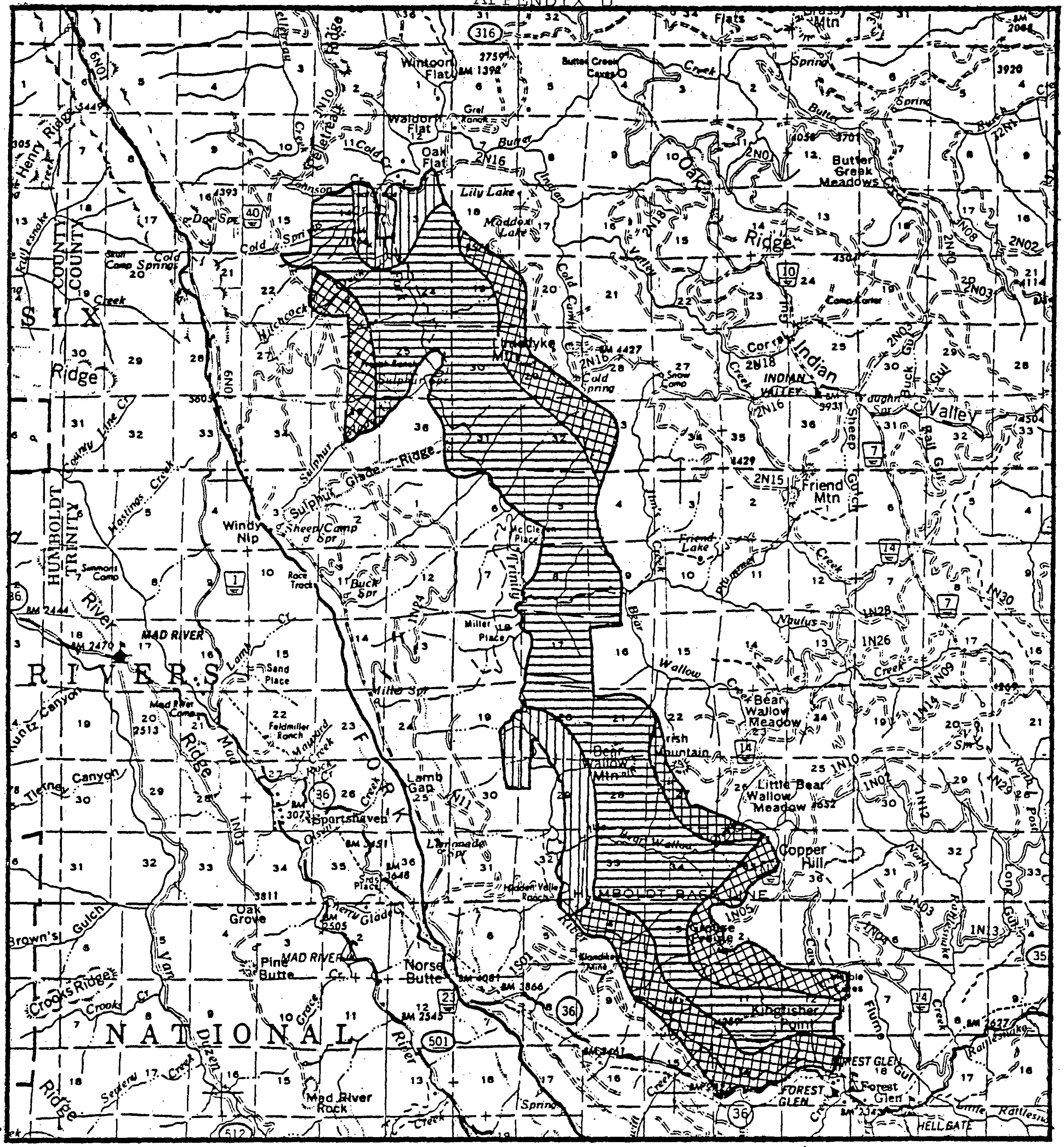
Unit 97 (Alternatives 3, 5, and 6)

Harvest System and Silvicultural Prescription: Helicopter Individual Tree Mark

Mitigation Measures:

50 foot SMZO-3 for sensitive designated streamcourses within unit (BMP 1-8)
Lop and scatter logging slash (BMP 1-14)

APPENDIX D



LEGEND	
(horizontal lines)	SEMI-PRIMITIVE NON-MT.
(cross-hatch)	ROADED NATURAL
(vertical lines)	RURAL

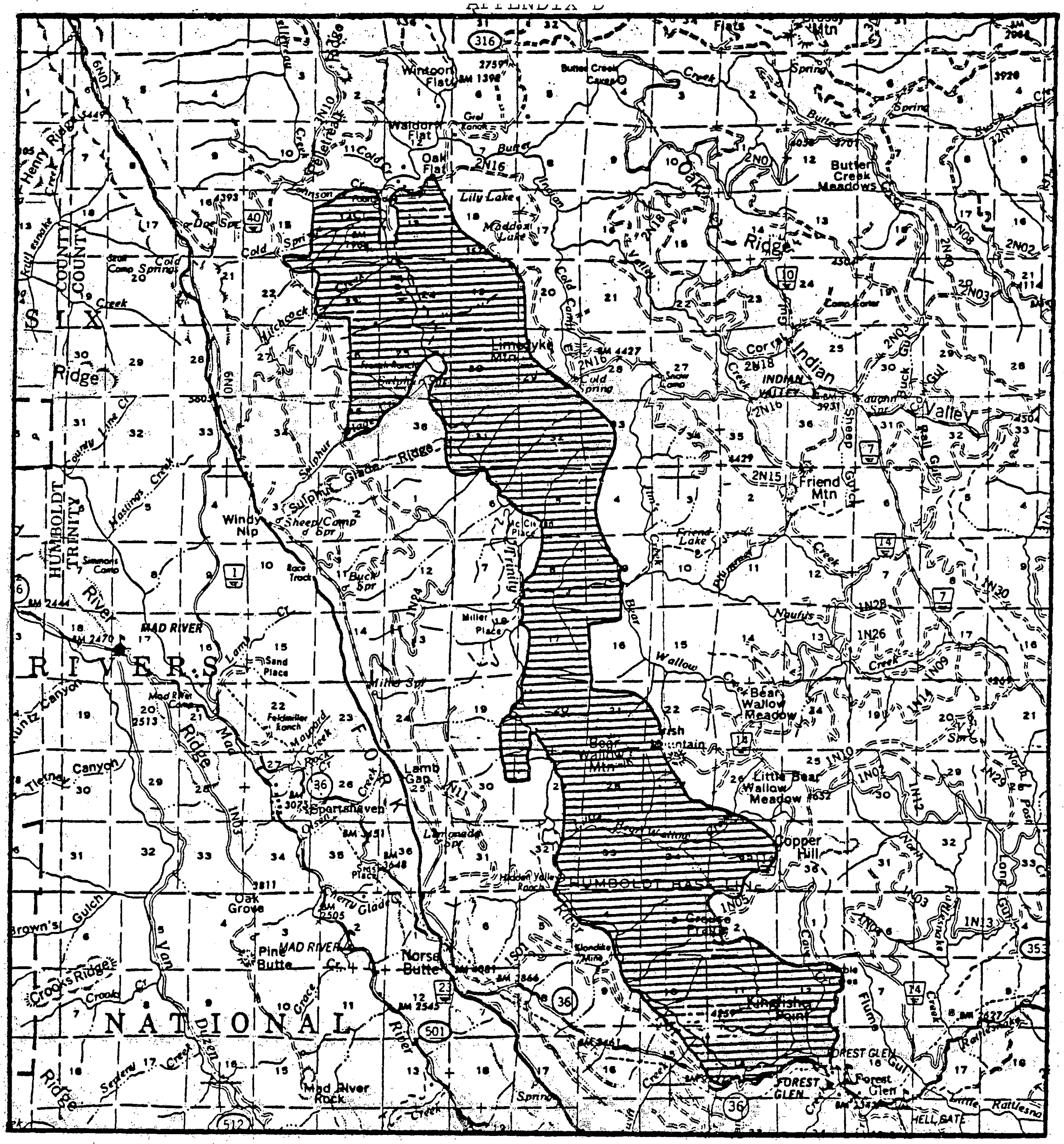
SOUTH FORK FIRE
RECOVERY / SALVAGE PROJECT

RECREATION OPPORTUNITY

EXISTING CONDITIONS

N

$\frac{1}{2}$" = ONE MILE



LEGEND	
▤	RETENTION
▩	PARTIAL RETENTION
≋	MODIFICATION
▥	MAXIMUM MODIFICATION
☐	
☐	

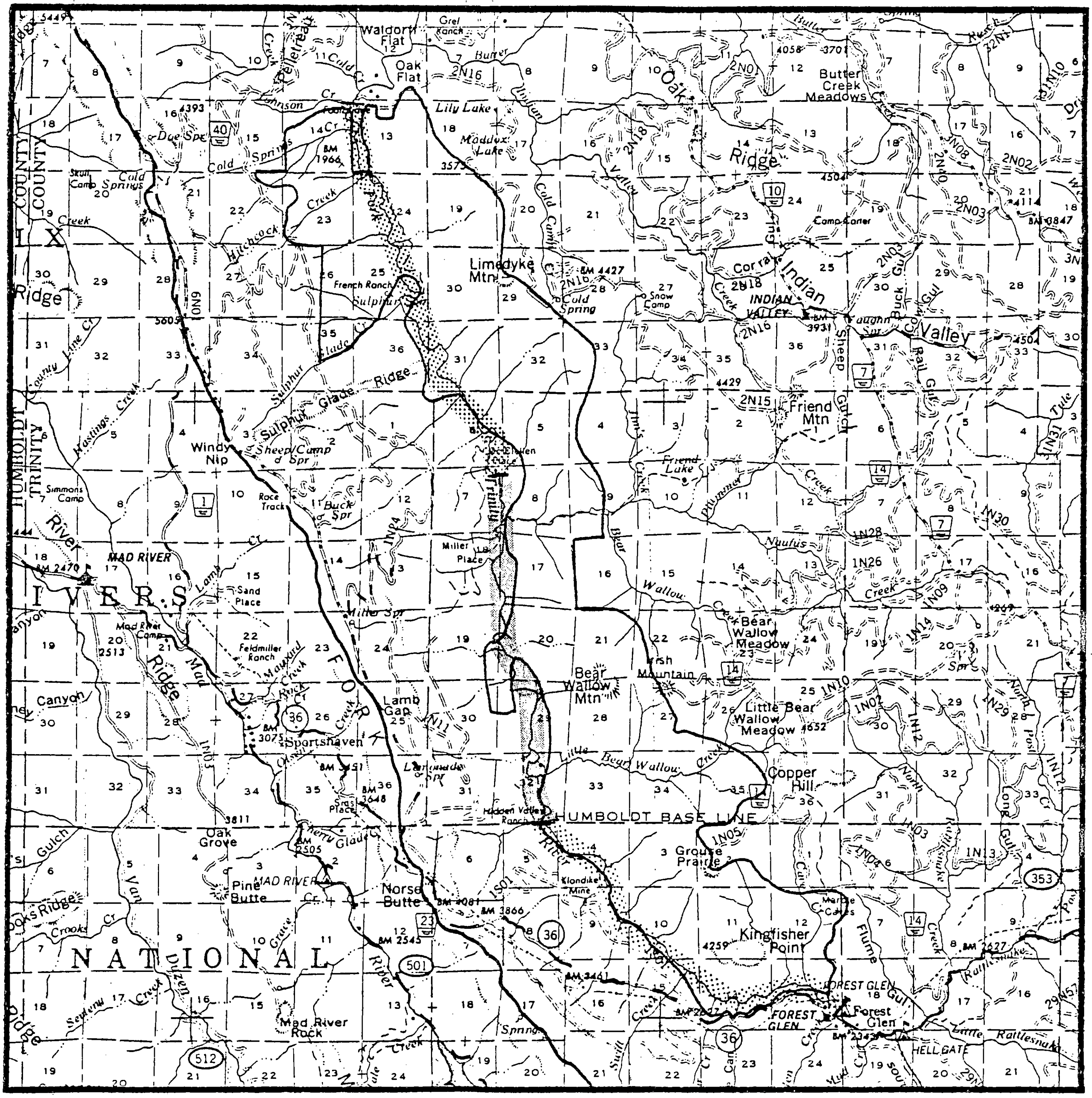
SOUTH FORK FIRE
RECOVERY/SALVAGE PROJECT

VISUAL QUALITY

EXISTING CONDITIONS

N

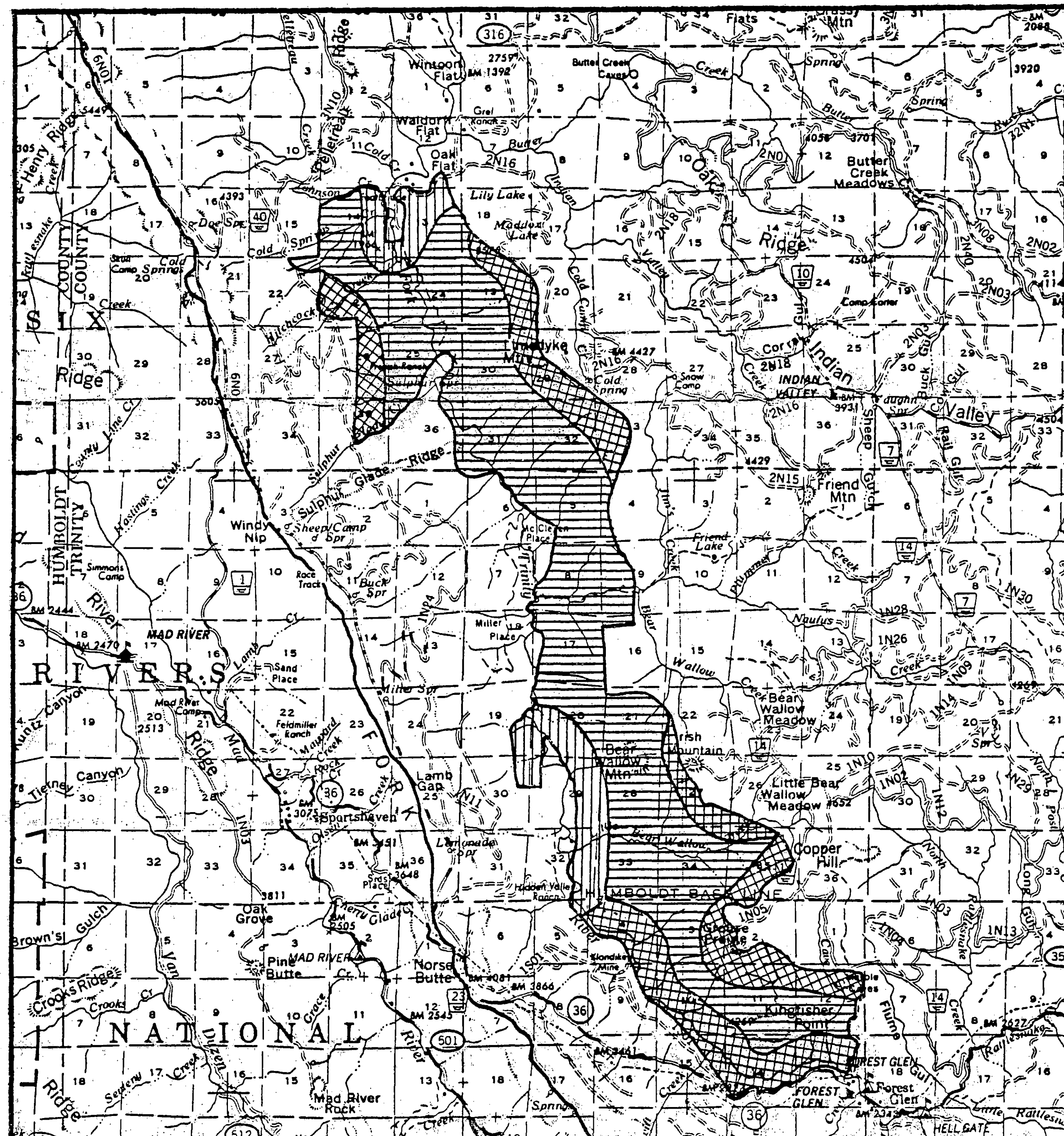
$\frac{1}{2}$" = ONE MILE



LEGEND
WILD RIVER
SCENIC RIVER

SOUTH FORK FIRE RECOVERY/SALVAGE PROJECT

WILD AND SCENIC RIVER



LEGEND

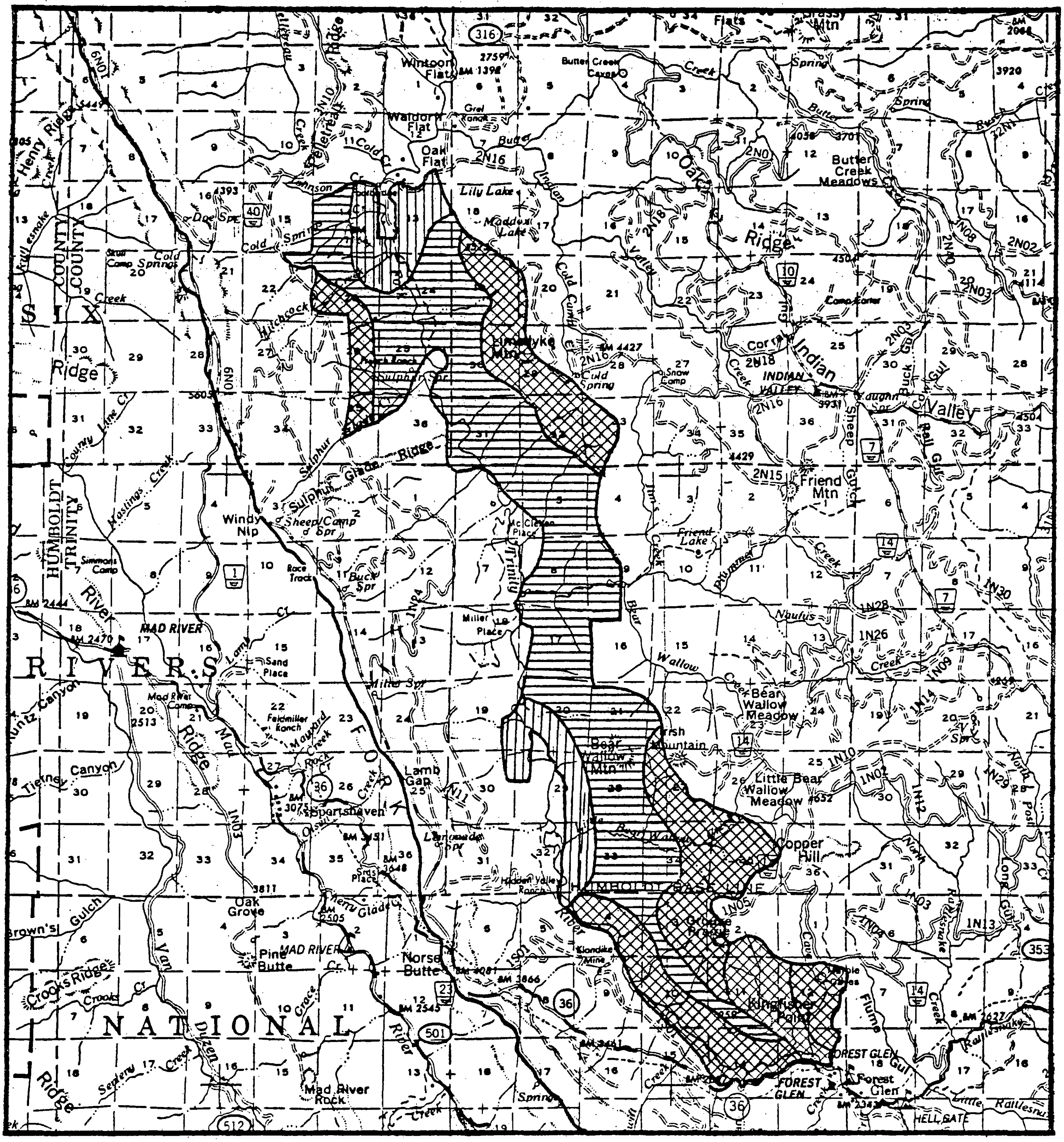
- SEMI-PRIMITIVE NON-MT.
- ROADED NATURAL
- RURAL

SOUTH FORK FIRE
RECOVERY/SALVAGE PROJECT

RECREATION OPPORTUNITY ALTERNATIVES 1 & 2

N

1/2" = ONE MILE



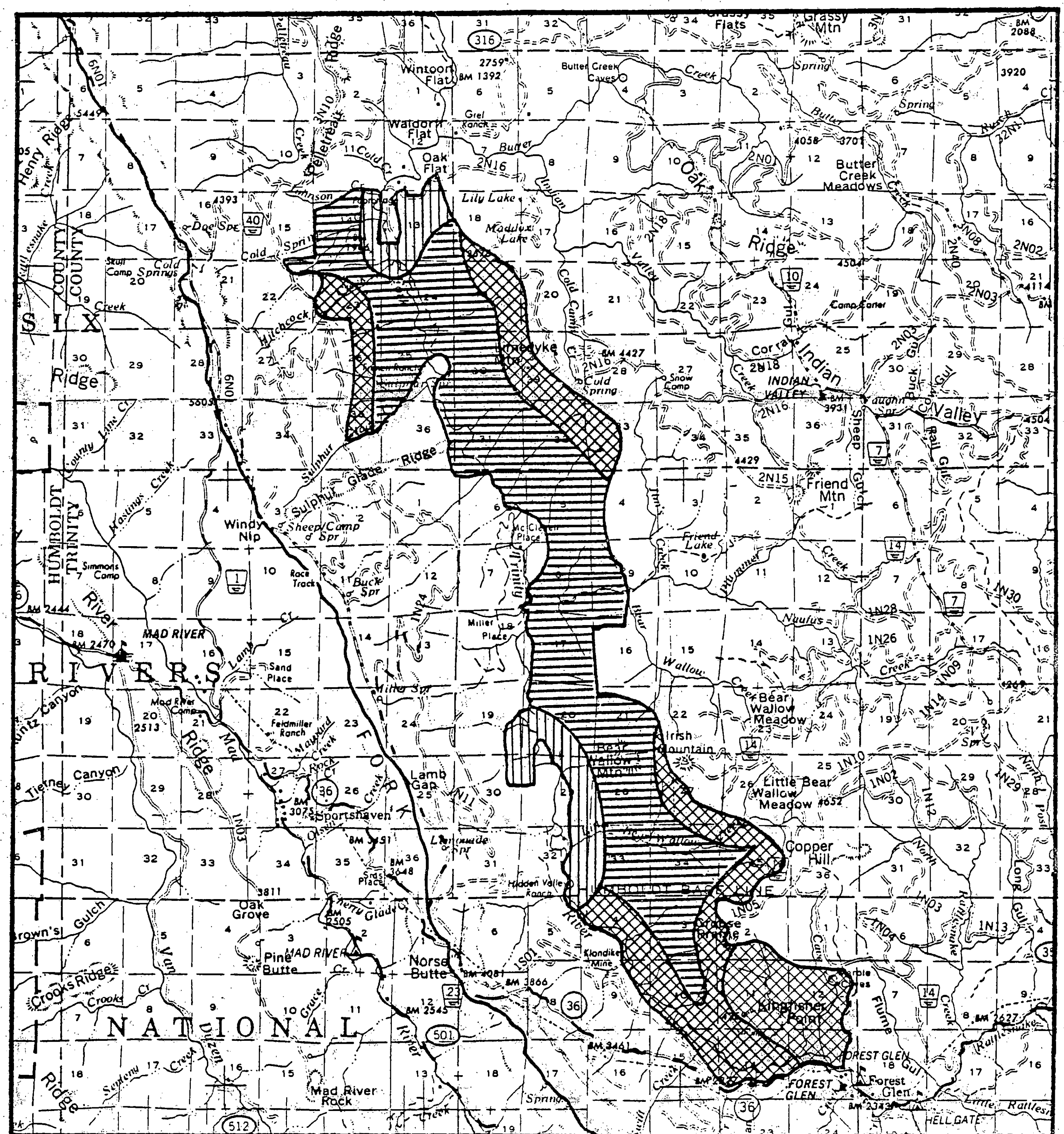
LEGEND	
[horizontal hatching]	SEMI-PRIMITIVE NON-MT.
[cross hatching]	ROADED NATURAL
[vertical hatching]	RURAL

SOUTH FORK FIRE
RECOVERY / SALVAGE PROJECT

RECREATION OPPORTUNITY
ALTERNATIVE 3

N

$\frac{1}{2}$" = ONE MILE



LEGEND

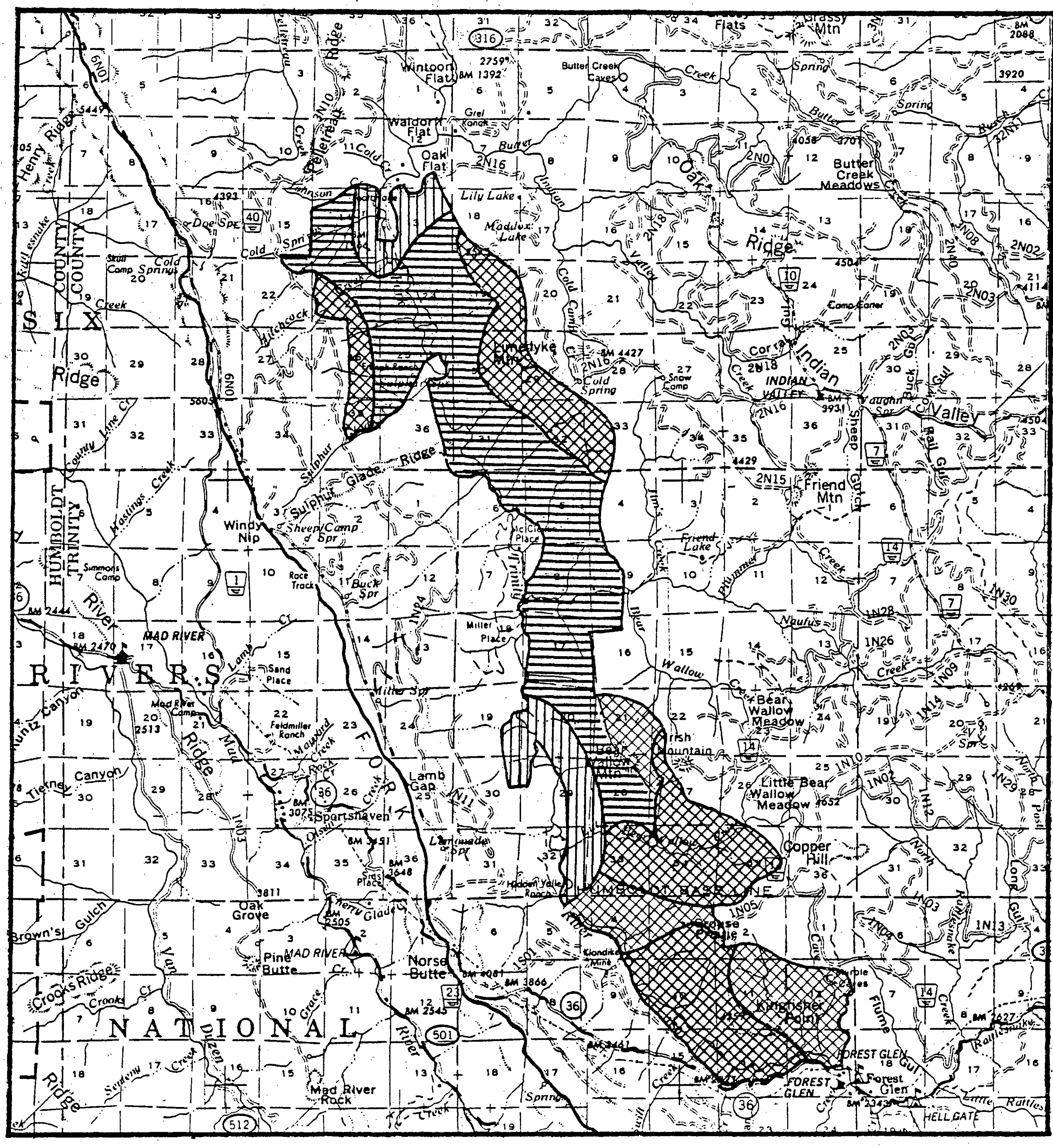
- SEMI-PRIMITIVE NON-MT.
- ROADED NATURAL
- RURAL

SOUTH FORK FIRE
RECOVERY/SALVAGE PROJECT

RECREATION OPPORTUNITY
ALTERNATIVE 4

N

$\frac{1}{2}$" = ONE MILE



LEGEND

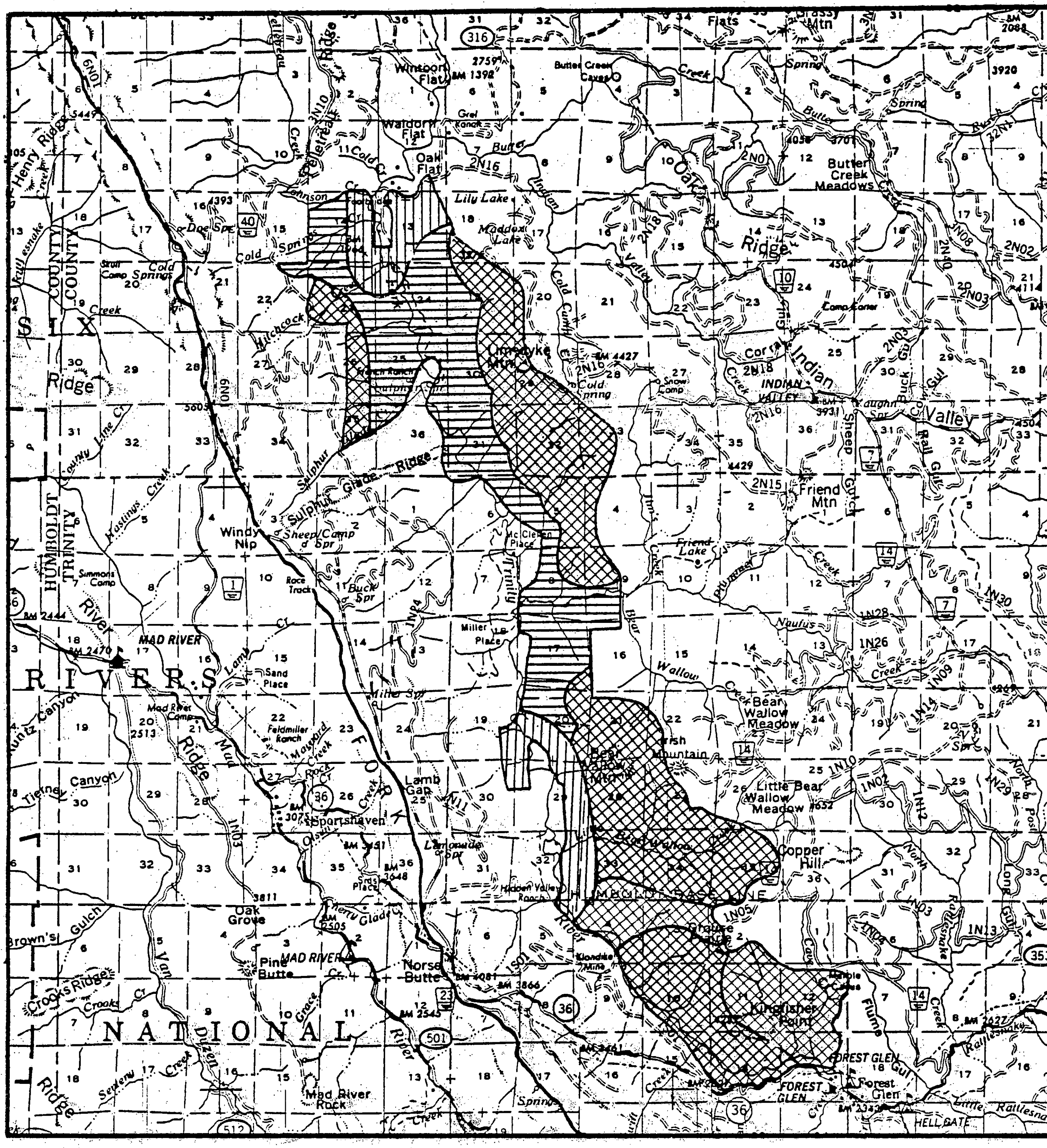
- SEMI-PRIMITIVE NON-MT.
- ROADED NATURAL
- RURAL

SOUTH FORK FIRE
RECOVERY/SALVAGE PROJECT

RECREATION OPPORTUNITY
ALTERNATIVE 5

N

$\frac{1}{2}$" = ONE MILE



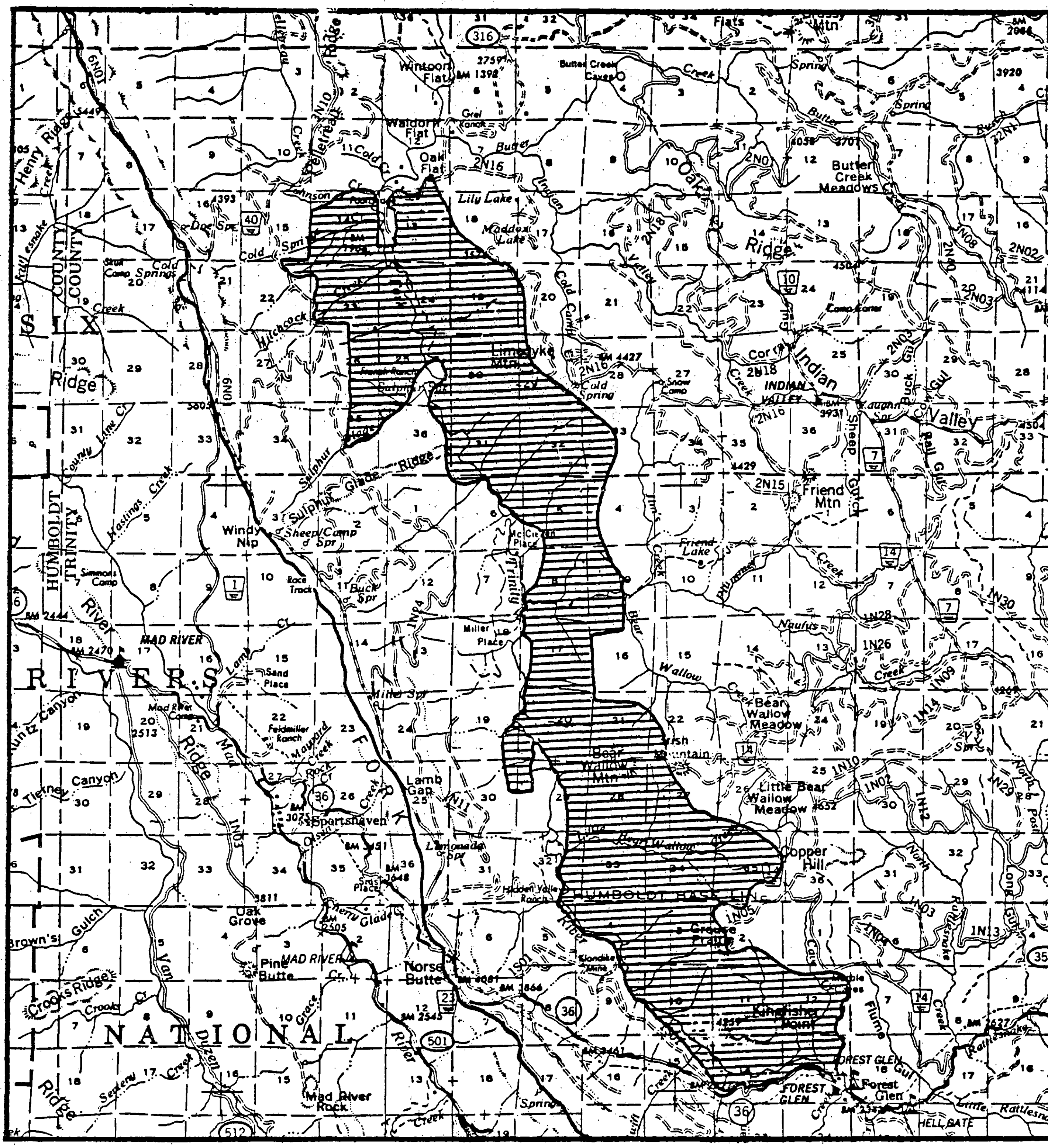
LEGEND	
(horizontal hatching)	SEMI-PRIMITIVE NON-MT.
(cross hatching)	ROADED NATURAL
(vertical hatching)	RURAL

SOUTH FORK FIRE
RECOVERY/SALVAGE PROJECT

RECREATION OPPORTUNITY
ALTERNATIVE 6

N

$\frac{1}{2}$" = ONE MILE



LEGEND

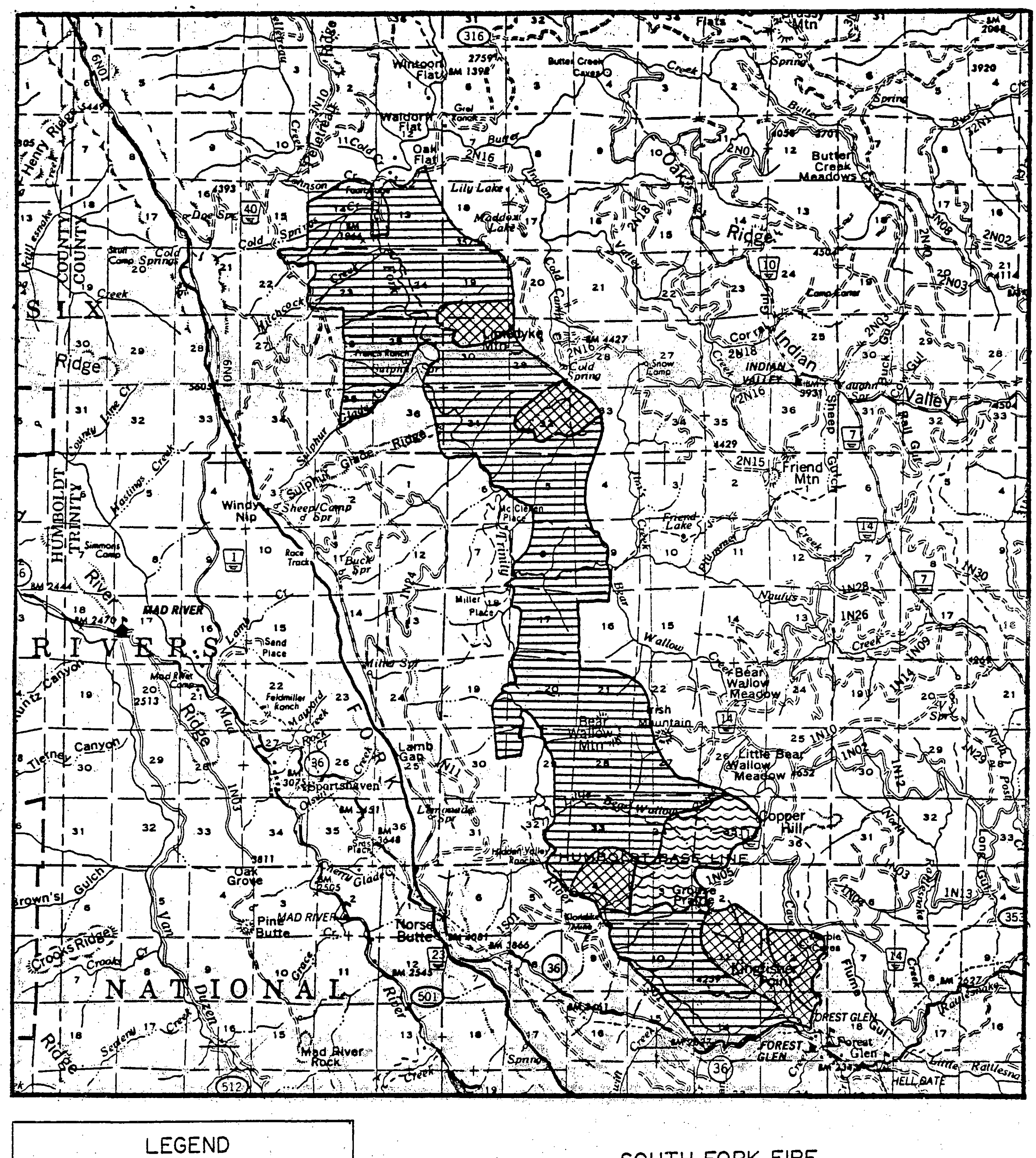
- RETENTION
- PARTIAL RETENTION
- MODIFICATION
- MAXIMUM MODIFICATION

SOUTH FORK FIRE
RECOVERY/SALVAGE PROJECT

VISUAL QUALITY
ALTERNATIVE 1 & 2

N

$\frac{1}{2}$" = ONE MILE



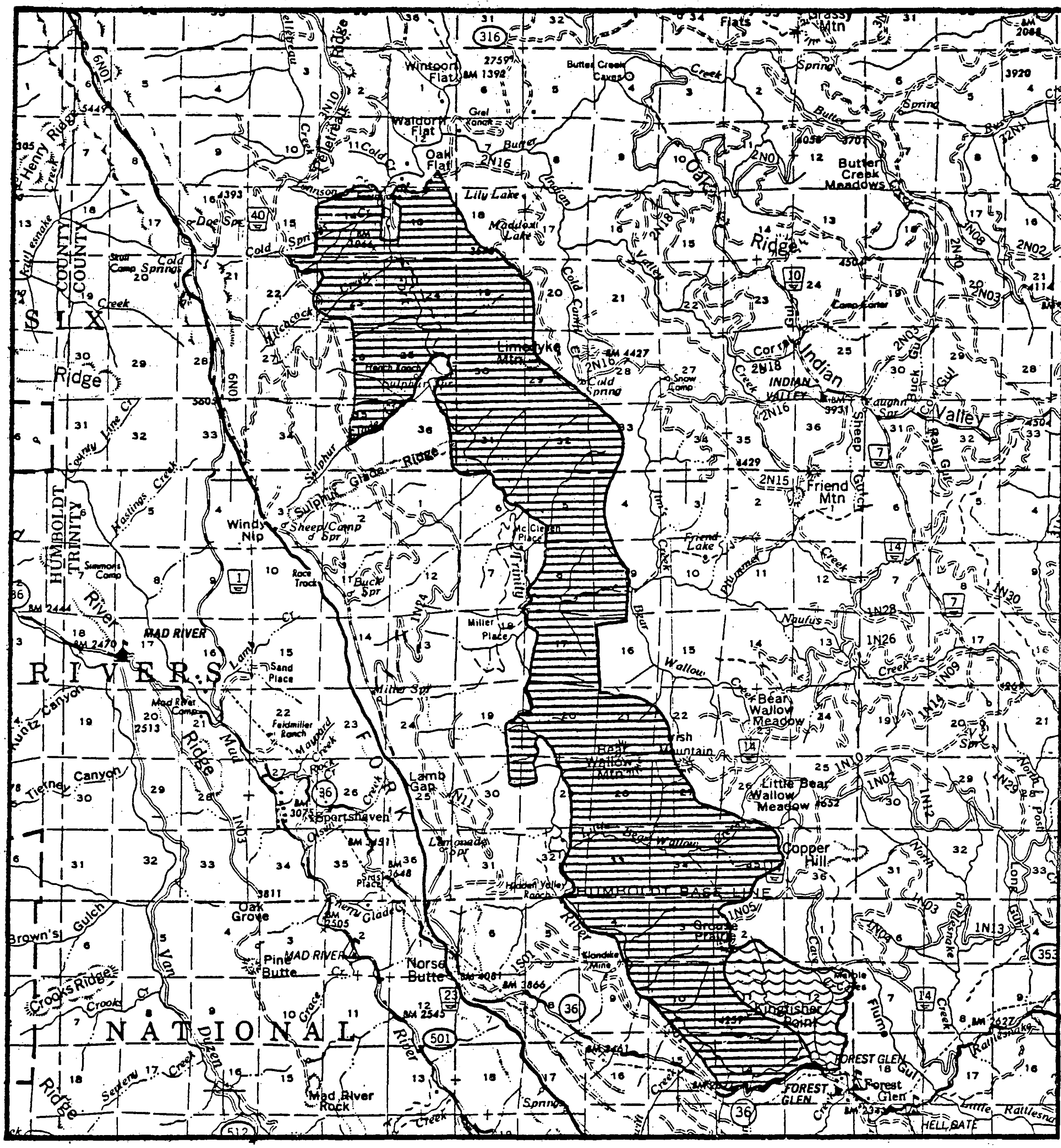
LEGEND	
▤	RETENTION
▩	PARTIAL RETENTION
≋	MODIFICATION
▥	MAXIMUM MODIFICATION
☐	
☐	

SOUTH FORK FIRE
RECOVERY/SALVAGE PROJECT

VISUAL QUALITY
ALTERNATIVE 3

N

$\frac{1}{2}$" = ONE MILE



LEGEND

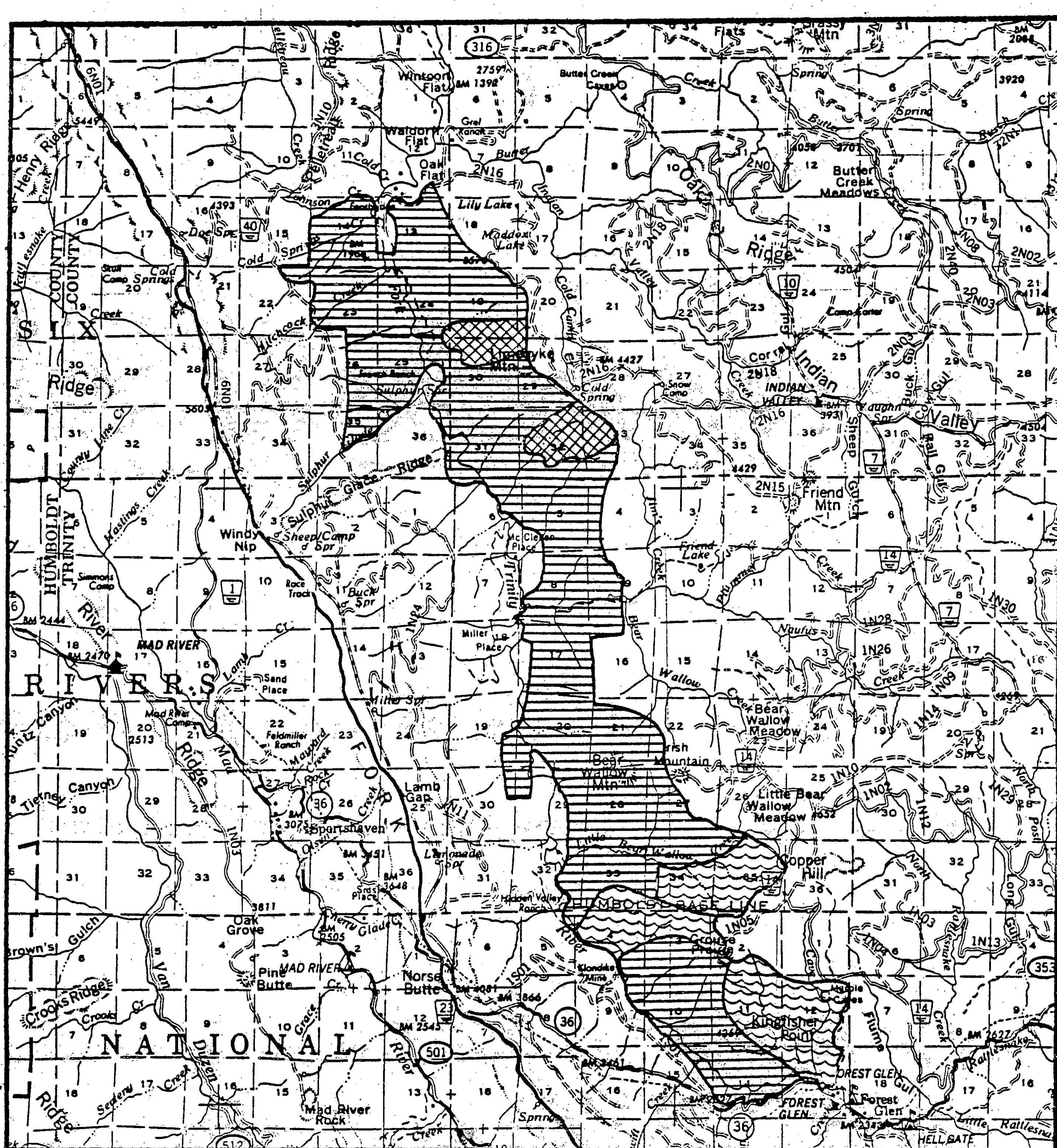
- RETENTION
- PARTIAL RETENTION
- MODIFICATION
- MAXIMUM MODIFICATION

SOUTH FORK FIRE
RECOVERY/SALVAGE PROJECT

VISUAL QUALITY
ALTERNATIVE 4

N

$\frac{1}{2}$" = ONE MILE



LEGEND	
	RETENTION
	PARTIAL RETENTION
	MODIFICATION
	MAXIMUM MODIFICATION

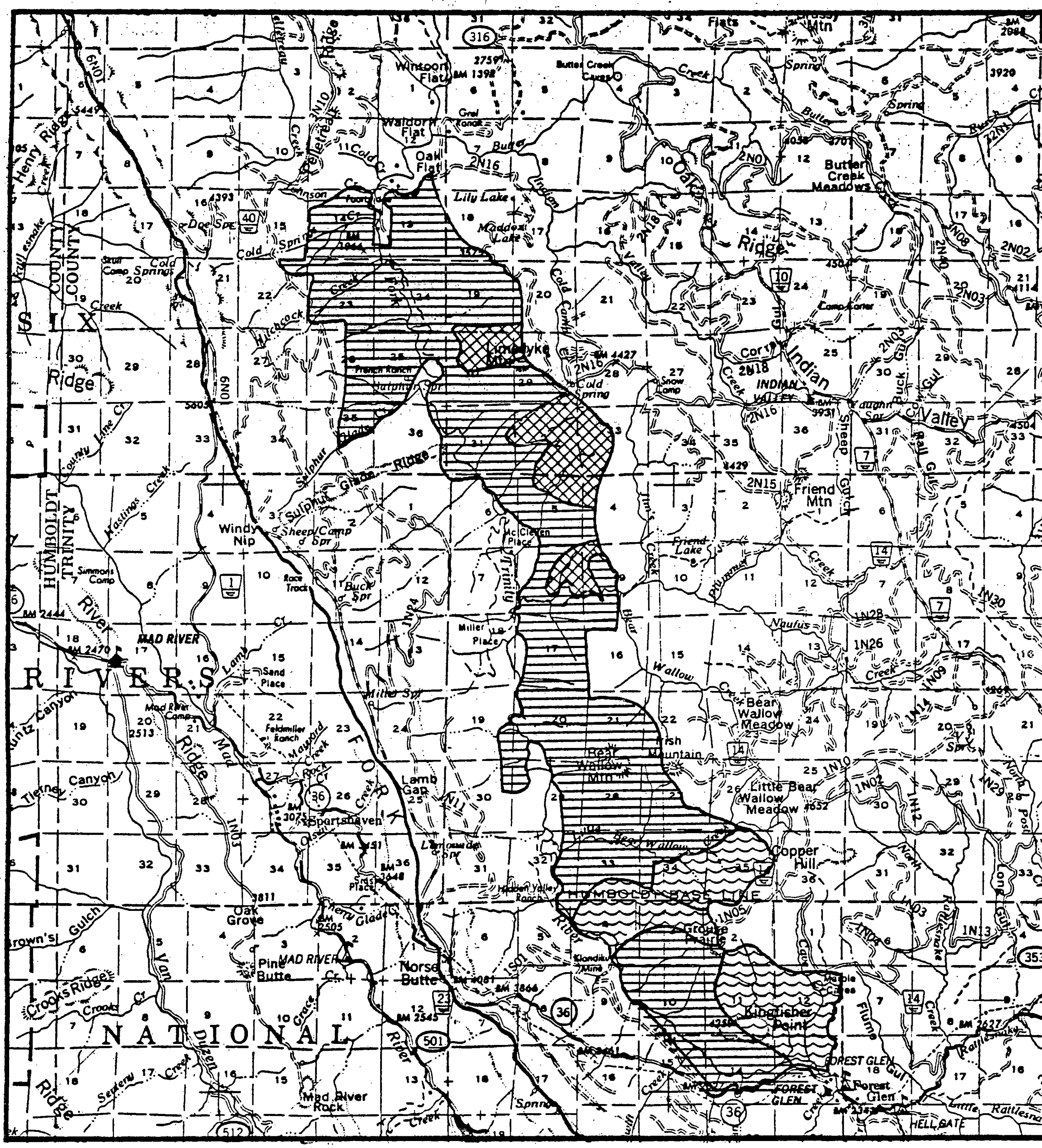
SOUTH FORK FIRE

RECOVERY/SALVAGE PROJECT

VISUAL QUALITY ALTERNATIVE 5

N

$\frac{1}{2}$" = ONE MILE



LEGEND

- RETENTION
- PARTIAL RETENTION
- MODIFICATION
- MAXIMUM MODIFICATION

SOUTH FORK FIRE
RECOVERY / SALVAGE PROJECT

VISUAL QUALITY
ALTERNATIVE 6

N

$\frac{1}{2}$" = ONE MILE

APPENDIX E

APPENDIX E

United States
Department Of
Agriculture

Forest
Service

Hayfork R.D.

Date: August 6, 1988

Reply To: 1920/2670

Subject: South Fork Fire Recovery/Salvage Project Botany Report

To: District Ranger, Hayfork R.D.

As discussed in my memo of April 11, 1988, potential habitat was identified for two Sensitive plant species within the proposed South Fork Fire Recovery/Salvage Project area. The sites identified as potential habitat were either small outcroppings of rock or serpentine soil. The species that are potentially found on these kinds of sites are Madia doris-nilesiae and Sedum laxum ssp. flavidum.

None of this type of habitat is located within proposed project management sites for either salvage or recovery efforts. Several such outcroppings were identified either near or adjacent to project sites, and these areas were searched for Sensitive plants even though they would not be impacted by project activities. No populations of Madia, Sedum or any other Sensitive or rare plant species were discovered.

In summary, after evaluation of all available maps, records and information, and field reconnaissance of all potential habitat that could be affected by any of the alternatives considered, it is my judgement that no Sensitive, Threatened, Rare or Endangered plants will be affected in any way by this proposed project.

Revegetation of Riparian and Non-commercial Sites

As the moderate and high intensity fires did not burn any major drainages containing riparian vegetation within the project area, there is very little opportunity for restoration work in the form of revegetation of riparian species. If any areas suitable for riparian vegetation are identified I recommend planting primarily big leaf maple (Acer macrophyllum, a fast growing species that could provide some shade sooner for slower growing species), white alder (Alnus rhombifolia, also a fast growing species that can stand the sunny environment in the burned areas), and willows (Salix spp., which can be obtained easily and inexpensively from cuttings of existing plants). A number of other species are suitable and available for planting in riparian areas (see attached).

Six-foot spacing for planting is suggested, pending additional species-specific information.

A large number of acres burned within this project area that are classified as non-commercial timber growing land. Some salvage will be removed from these areas and subsequent opportunities exist for restoration revegetation efforts. Planting non-commercial native plant species would help restore the areas to their natural state and would potentially benefit wildlife. See the attached list for suggested species:

Potential Species for use in Restoration of Riparian Areas

Hayfork Ranger District, Shasta-Trinity National Forests

STREAMSIDE, RIPARIAN ZONE

Common name	Scientific name	Sources and Availability	Notes
big leaf maple	Acer macrophyllum	CCC 1g, FF	Fast growing
box elder	Acer negundo	CCC t,1g	Fast growing, suckers
white alder	Alnus rhombifolia	CCC t,1g	Fast growing, stands sun but likes moisture.
red alder	Alnus oregana (rubra)	CCC, FF, PW	Fast growing
mountain dogwood	Cornus nuttallii	FF, PW	Riparian shrub/tree
creek dogwood	Cornus stolonifera	NPI, FF, PW	Spreads by rootstalks
willow	Salix sp.	CCC	Fast growing
Douglas spiraea	Spiraea douglasii	FF	Low plant, sun/shade

TOLERATES MOIST STREAMSIDE ZONE AND DRIER AREAS UPSLOPE

Common name	Scientific name	Sources and Availability	Notes
buckeye	Aesculus californica	CCC 1,	Mod. fast growing, stands sun but likes moisture.
service berry	Amelanchier pallida (A. alnifolia)	NPI, FF	suckers, likes sun & water can root cuttings/suckers
incense cedar	Calocedrus decurrens	CCC , FF	Slopes above immed. ripari
deer brush	Ceanothus integerrimus	CCC t, PW, NPI	Likes sun, light shade, wa
ponderosa pine	Pinus ponderosa	CCC t, 1g	Slopes avove immed. ripari
western choke cherry	Prunus virginiana	NPI, FF, PW	Likes sun & water, suckers
Douglas fir	Pseudotsuga menziesii	CCC t	Slopes above immed. ripari
thimbleberry	Rubus parviflorus	FF	Tolerates sun or shade
elderberry (blue)	Sambucus caerulea	CCC t,1g,PW,NPI	Likes sun & water
snowberry	Symphoricarpus albus (S. rivularis)	CCC,NPI,FF,PW	Riparian & upslope low shr

FOUND ONLY ON DRIER UPPER SLOPES OF DRAINAGES

Common name	Scientific name	Sources and Availability	Notes
canyon live oak	Quercus chrysolepis	CCC 1g, FF	Drier upper slopes, wildli

Potential Species For Use in Restoration of Non-Commerial Burned Areas

Hayfork Ranger District, Shasta-Trinity National Forests

VALUE TO WILDLIFE	SPECIES	COST	SOURCES AND AVAILABILITY
browse shrub, ST nitrogen fixing	Ceanothus cuneatus buckbrush		
browse shrub, PR nitrogen fixing	Ceanothus integerrimus deerbrush		NPI, PW, CCC
browse shrub, PR	Cercocarpus betuloides mountain mahogany		NPI, PW
berry producing shrub PR	Prunus virginiana choke cherry		NPI, PW, FF
berry producing shrub ST	Rhamnus californica coffee berry		
berry producing shrub ST	Rosa spp. rose		
berry producing shrub PR	Sambucus caerulea elderberry		NPI, PW, CCC
native perennial grass PR	Festuca idahoensis Idaho fescue		NPI
native perennial grass ST	Sitanion hystrix bottlebrush squirreltail		NPI
legume, forb, ST nitrogen fixing needs inoculation	Lotus sp. bird's foot trefoil		
annual seed producer PR	Eschscholzia californica California poppy		NPI

Value to wildlife: PR = preferred species ST = staple

Sources and Availability of Native Plants for Restoration and Revegetation

CCC = California Conservation Corps, Napa Satellite and Native Plant Nursery
PO Box 7199
Napa, Ca. 94558 (707) 253-7783 t = TUBLINGS 1g = 1 GALLON CONTAINERS

NPI = Native Plants Inc. SEED
PO Box 177
Lehi, Utah 84043 (801) 786-4422 (801) 531-1456

FF = Forest Farm TUBED SEEDLINGS AND/OR 1 GALLON CONTAINERS
990 Tetherow Rd
Williams Oregon, 97544 (503) 846-6963

PW = Plants of the Wild (Palouse Seed) TUBED SEEDLINGS
PO Box 866
Tekoa, Wa 99033 (509) 284-2848

/S/ BARBARA L. WILLIAMS
Forest Botanist

APPENDIX F

APPENDIX F

BIOLOGICAL EVALUATION

SOUTH FORK FIRE RECOVERY/SALVAGE PROJECT

Shasta-Trinity National Forests

Hayfork Ranger District

May 1988

Prepared by: Linn W. Shipley 5/9/88
LINN W. SHIPLEY Date
Wildlife Biologist

Recommended by: Mary J. Snider 5/11/88
for DAVID W. WICKWIRE Date
District Ranger

Reviewed by: Ken Coop 5/16/88
KEN COOP Date
Wildlife Management

Approved by: Randall, for 5/18/88
ROBERT R. TYRREL Date
Forest Supervisor

This biological evaluation of threatened, endangered, and sensitive plant and animal species documents the agency review for the South Fork Fire Recovery/Salvage Project.

Threatened Species

Informal consultation with the USFWS determined that there are no threatened or candidate plant or animal species, or critical habitat in the proposed project area [1].

Requests to the public for input regarding threatened, endangered, and sensitive species did not identify any new sites or sighting records (See South Fork EIS Public Involvement and Documentation file).

Endangered Species

Informal consultation with the USFWS determined that there are no endangered plant species in the proposed project area [1].

Bald Eagle

Several sightings of bald eagles foraging along the South Fork of the Trinity River have been recorded (See District Wildlife Atlas).

Bald eagles have reportedly nested near the mouth of Plummer Creek. A survey in 1983 located three inactive nests. Nesting surveys have been conducted every year (except 1986), including a helicopter survey this year. The surveys failed to locate any active nests (See District files). Habitat for nesting is poor due to low densities of primary food sources, such as fish carcasses or other carrion.

None of the proposed actions will result in reduced quantity or quality of the existing fisheries resource [2]. None of the proposed actions will occur within 1/4 mile of the South Fork of the Trinity River. At least 75 percent of all bald eagle nests are located within 1/4 mile of a water body [3]. Therefore, none of the proposed actions will have any adverse affect on bald eagles or their potential nesting habitat.

Peregrine Falcon

The Wilderness Research Institute report, "Peregrine Falcon Nesting Habitat Survey Cliff Availability and Suitability Report for the Klamath and Shasta-Trinity Forests" [4] was reviewed for information pertaining to the project area. The report indicated that two potential aerie sites exist within the proposed project area. A third site was determined to be unsuitable after a helicopter survey was made.

Aerial photos at 1:12,000 scale taken in October 1987 and USGS topographical maps at 1:24,000 scale revised in 1983 were reviewed for additional sites. No additional sites were located.

Surveys conducted as recent as the last week in April indicate that a pair of peregrine falcons are actively nesting at one of the aerie sites. No other nesting peregrine falcons were located (See District files).

Informal consultation with the USFWS was initiated when peregrine falcons were located at this aerie site in 1986 (See District files). The purpose of the consultation was to develop site specific management direction that was acceptable to both agencies that would result in no impact to the peregrine falcons. The agreed upon direction has been included in the approved management plan [5].

For all alternatives considered in the South Fork Fire Recovery/Salvage Project, implementation of the approved management direction will result in no adverse affect to the peregrine falcons.

Sensitive Species

Pine Marten

No sightings of this species have been recorded in the project area; however, suitable habitat exists within the area.

Fisher

No sightings of this species have been recorded in the project area; however, suitable habitat exists within the area.

Goshawk

No sightings of this species have been recorded and no active nest sites have been located in the project area. Suitable habitat exists within the area.

Potential affects resulting from implementation of the proposed project for these three species were considered as part of the analysis for the selected MIS species for old growth, dense, mature stands of mixed conifer, dead and down material, and cumulative impacts (See below).

Spotted Owl

The Bear Wallow Spotted Owl Habitat Area [HF-12-SO(ST)] has been included in the management matrix since 1981. The SOHA's inclusion in the matrix was based on the availability of suitable habitat, the presence of spotted owls, and distance requirements between other SOHA's. A management plan for the SOHA was written and approved in 1986 [6]. As a result of the fires, the plan was revised in 1988 [7].

A spotted owl was sighted in the Bear Wallow Creek area in 1981, vocal responses from a pair of spotted owls was recorded in 1982, an immature female was sighted in 1985, an immature male was sighted in 1987, and a pair of adults were sighted in 1988. The SOHA has been included in the

Region 5 monitoring program, and will continue to be monitored each year for occupancy and the reproductive status of the owls.

The spotted owl was the selected MIS for old growth, dense, mature stands of mixed conifer, dead and down material, and snags. Cumulative impacts to spotted owl habitat caused by last year's fires has been documented [8]. Many of the SOHA's were underburned, with little damage to the overstory. Very little habitat was lost to high intensity fire. The cumulative impacts of timber management activities were also analyzed for this species.

The wildlife assessment criteria that were measured for this proposed project were habitat diversity levels and habitat components for selected management indicator species. A summary of the more significant assessment criteria follows:

Diversity	-	Provide and maintain a minimum of 5 percent of each vegetative-timber type/seral stage combination.
Spotted Owl	-	Maintain at least 1000 acres of suitable habitat at all times.
		The 1000 acres will include the contiguous 300-acre designated core and at least one 300-acre contiguous replacement. The remaining 400 acres may occur in 3 or less parcels, none of which is to be less than 60 acres in size.
	-	2.5 snags per acre in emphasis areas.
		1.5 snags per acre in all other areas.
		No more than 8 snags per acre may be counted toward the requirement.

None of the alternatives will conflict with existing management plans or agency direction for other wildlife species or habitat. These include spotted owl, bald eagle, peregrine falcon, and black-tailed deer management and recovery plans.

None of the alternatives will significantly impact the climax seral stages. The acreage and percentages in these seral stages will remain the same over the long and short term. Other aspects of diversity (richness, evenness, pattern, and cumulative impacts related to them) pertaining to the spotted owl MIS were also not significantly impacted.

None of the proposed alternatives will impact currently suitable timber stands identified for the long and short term management of spotted owl habitat. Natural recruitment from falling snags and additional tree mortality will increase densities of dead and down material for prey base species over the short term, approaching pre-fire levels. Habitat capability will exceed 100 percent over the long term in areas where no management activities take place. Planting conifers at higher densities in the SOHA than would normally be done for timber management purposes will result in suitable habitat becoming established at a higher rate of success [9].

Summer Steelhead Trout

As stated above, none of the proposed actions will result in reduced quantity or quality of the existing fisheries resource [2].

Sensitive Plants

None of the proposed actions will adversely affect any known populations of sensitive listed plants. Management direction is adequate to protect any listed plants that may be located during project implementation [10].

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APPENDIX F

Shasta-Trinity National Forests
Hayfork Ranger District

BEAR WALLOW

SPOTTED OWL HABITAT AREA MANAGEMENT PLAN

REVISION NO. 1

May 1988

Written By Linn W. Shipley Date 5/9/88
LINN W. SHIPLEY, Wildlife Biologist

Recommended By Mary L. Smelser for Date 5/11/88
DAVID W. WICKWIRE, District Ranger

Reviewed By Ken Coop Date 5/16/88
KEN COOP, Wildlife Management Officer

Approved By , for Date 5/18/88
ROBERT R. TYRREL, Forest Supervisor

I. INTRODUCTION

The Bear Wallow Spotted Owl Territory Management Plan was approved on October 15, 1986. On August 30, 1987 lightning ignited the Wallow Fire which burned approximately 95 percent of the area within the territory circle. Most of the area burned with low intensity, which did not significantly change the habitat characteristics. However, 122 acres of the timber stands identified for management of spotted owl habitat burned with high intensity, resulting in unsuitable habitat. Although the remaining habitat remains intact, potential impacts from fire salvage sales and clarification of existing policy from the Regional Office (2670 memo dated 11/10/87) indicate that the plan should be revised. This revision is part of the original plan, those items that were not revised remain the same as in the original plan.

II. RESOURCE DESCRIPTION

Fire intensity was high on the 122 acres of burned land (from definitions in the Burned Area Emergency Rehabilitation Handbook, FSH 2509.13). See Figure 1. Of the 1164 acres identified in the 1986 management plan as currently suitable (and managed as such), 57 acres were burned and are now considered unsuitable/capable. The remaining 65 acres of burned vegetation is divided into acreage identified as unsuitable/capable and remains so, and 3 small fires which burned 4 acres or less of currently suitable habitat. These small fires were located in 4C+ seral stage vegetation and are considered as part of the natural process of generating snags, and dead and down material in those stands.

Post-fire aerial photo interpretation and partial on-the-ground verification resulted in the following current habitat classifications (Figure 3):

DELINEATION	ACRES
Suitable	1056
Unsuitable/capable	617
subtotal	1673
Not capable (lands not managed for spotted owl)	1998
Private Ownership	851
total	4522

III. MANAGEMENT PLAN DIRECTION

The prescription selected to maintain suitable habitat over time for this habitat area is no scheduled timber harvest. This prescription was selected due to the lack of suitable and unsuitable/capable habitat to manage, to reduce the risk of habitat fragmentation, reduce the risk that habitat created under a timber harvest prescription will not become suitable, and to increase administrative effectiveness and economic efficiency in managing, implementing, and tracking resource management activities within the SOHA. Under this prescription, the implied rotation is 380 years. FORPLAN modelling indicates that this prescription will maintain at least 1000 acres of suitable habitat at all times.

All of the currently suitable habitat (1056 acres) is identified in this plan for management of spotted owl habitat. Another 617 acres of replacement habitat has also been identified to bring the total acres of habitat managed for spotted owls to 1673 acres. The replacement stands are expected to become suitable habitat in 50-200 years.

Note that no revisions have been made in the original plan tables because of the minimal effect of the 1987 fires on that plan.

IV. MITIGATION MEASURES, MANAGEMENT CONSTRAINTS, AND MONITORING PROCEDURES

1. Any and all planned activities which deviate from this plan within the areas designated to be managed for spotted owl habitat (Stands 1 - 14) must be coordinated through the District Ranger and Wildlife Biologist and appropriate approvals obtained.

2. If a nest site is discovered, no disturbing activity will be allowed within 1/4 mile radius of the identified nest stand from February 15 to August 15, or until the owlets disperse from the territory, unless approved by the District Wildlife Biologist.

3. The SOHA has been included in the Research, Development, and Administration (R, D, and A) program, and will be monitored on a yearly basis for at least the next five years. Types of monitoring to be accomplished include :

   A. Follow the monitoring procedures in the Spotted Owl Monitoring Handbook (Pacific Southwest Region, February 16, 1988). A minimum of two Biological Technicians will be required to complete the monitoring.

      i. Determine presence and pair occupancy - 6 completed visits per year
      ii. Determine reproductive status - 4 visits per year.

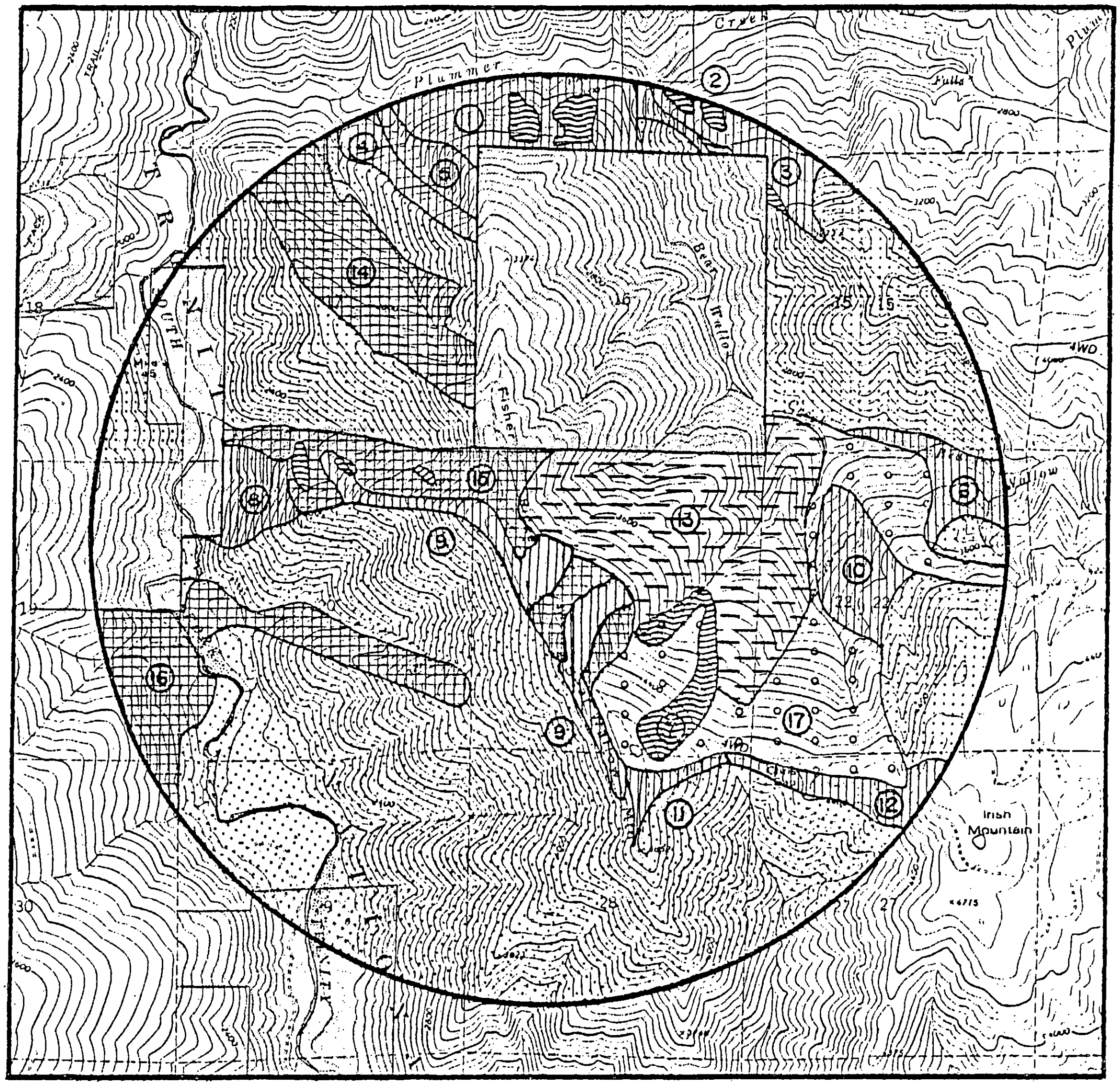
NOTE: All times listed here are maximums.

      iii. Habitat plots and analysis - 10 days per 5 years.

   B. Prey species population transects and analysis - 6 days per year for 3 years.

4. Travel corridors of suitable habitat to core areas within the territory and adjacent spotted owl habitats will be provided.

5. As necessary, habitat areas will be developed utilizing induced decadence (e.g., topping trees, increasing dead and down material, inoculating trees with fungus, creating man-made nest structures, etc.)



BEAR WALLOW
SPOTTED OWL TERRITORY

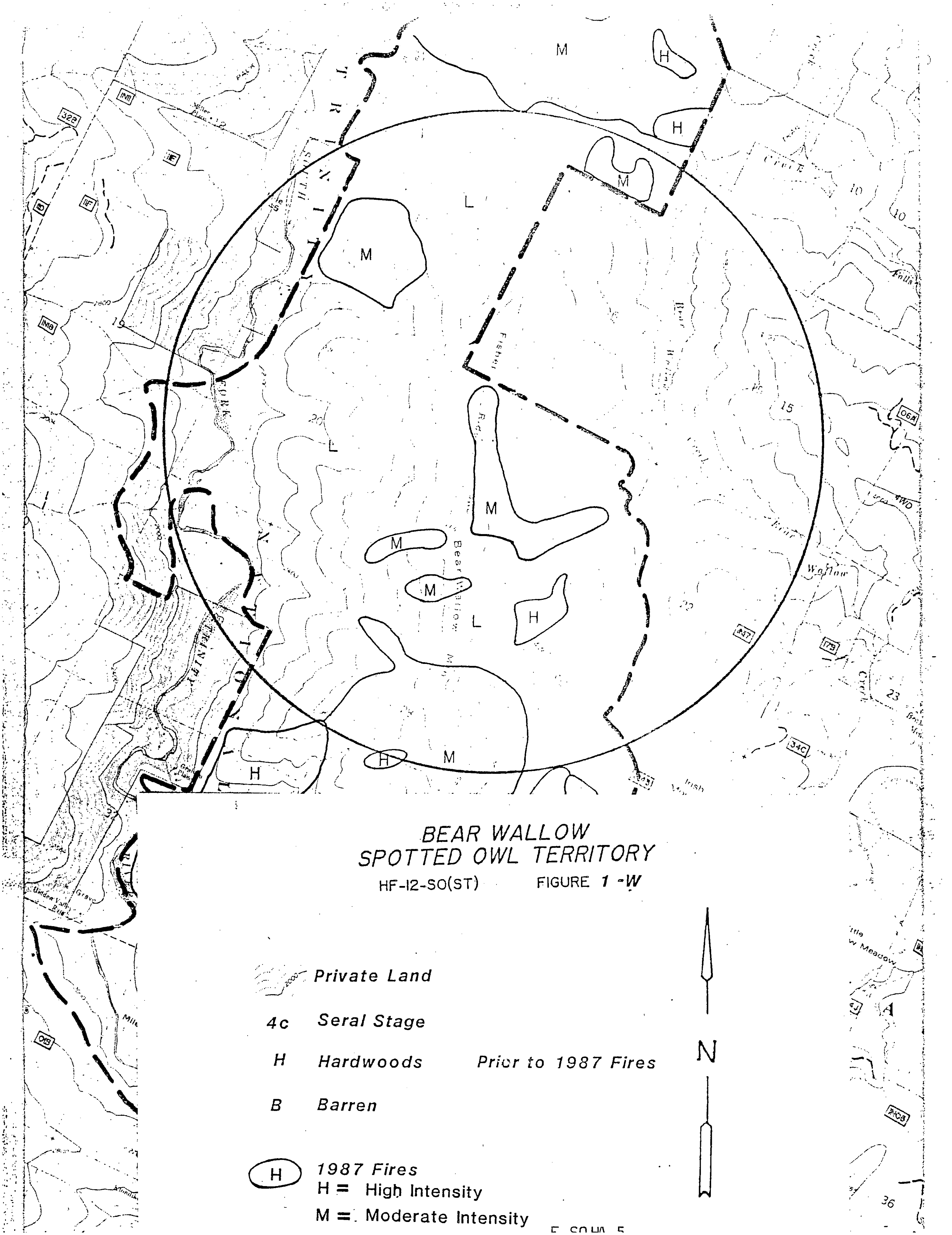
HF-12-SO(ST) FIGURE 2-W

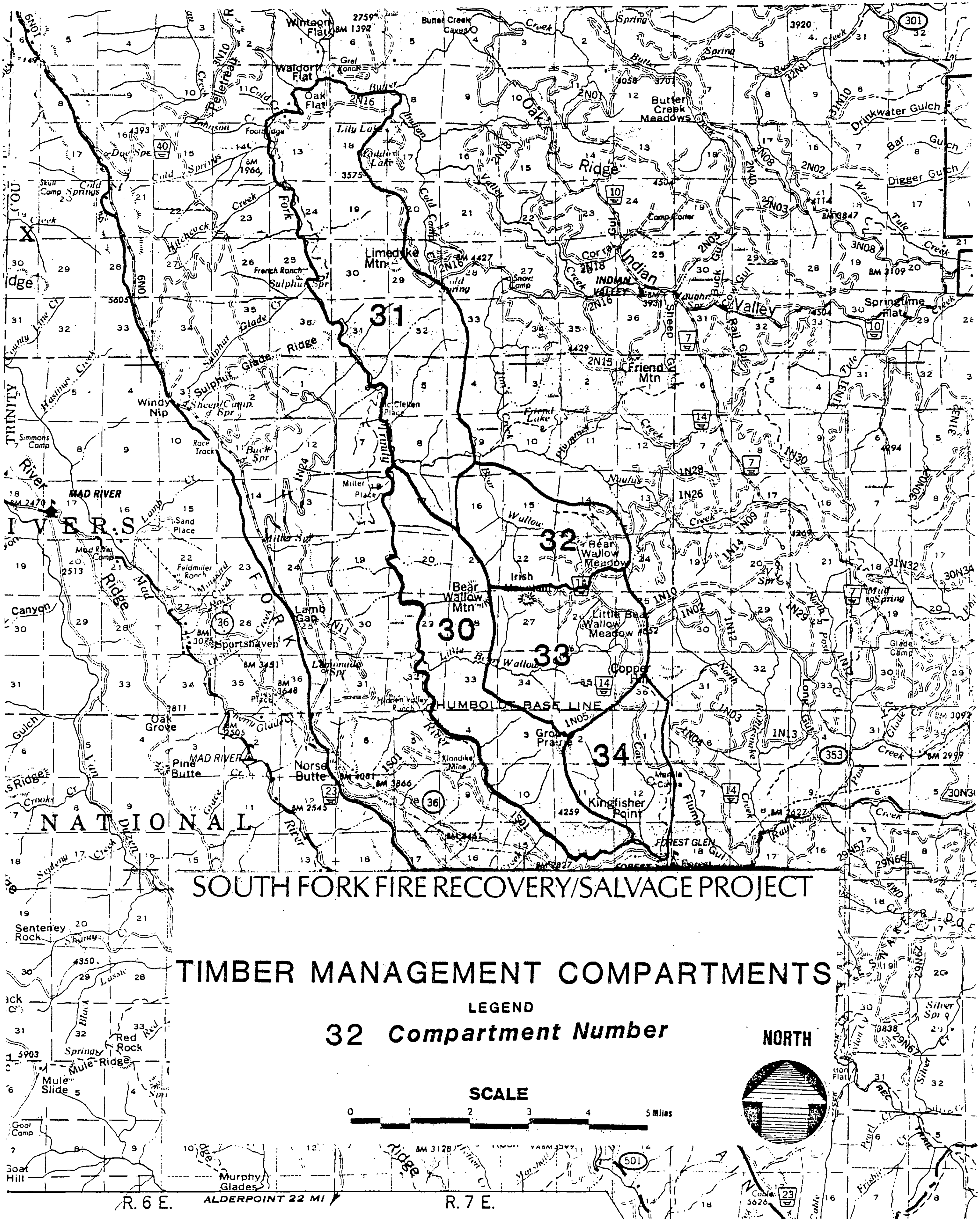
- Private Land
- (19) Stand Identifier
- 1987 Fires
- Core (C) (303 Acres)
- Core Replacement (CR) (300 Acres)
- Replacement (R) (566 Acres)
- Currently Suitable (CS) (504 Acres)
- Lands NOT Managed for Maintenance of Spotted Owl Habitat

STAND INFORMATION

Stand No.	ID	Stand Size	Stand No.	ID	Stand Size
1	R	116 Acres	9	R	95 Acres
2	R	9 Acres	10	R	70 Acres
3	R	54 Acres	11	R	19 Acres
4	R	37 Acres	12	R	39 Acres
5	R	26 Acres	13	C	303 Acres
6	R	52 Acres	14	CS	154 Acres
7	R	50 Acres	15	CS	157 Acres
8	R	50 Acres	16	CS	142 Acres
			17	CR	300 Acres

TOTAL R = 617
C = 1056


BEAR WALLOW
SPOTTED OWL TERRITORY
HF-12-SO(ST)
FIGURE 1 -W
Private Land
4c Seral Stage
H Hardwoods Prior to 1987 Fires
B Barren
H 1987 Fires
H = High Intensity
M = Moderate Intensity
N
Bear Wallow
Fisher
Creek
Wallow
Meadow
Irish
IN17
17B
06A
34C
4WD
15
10
23
36



F-CMP-1

U.S. DEPARTMENT OF AGRICULTURE

Appendix F TABLE 1-W

Present Diversity Levels - Total for NFS
Lands Capable of Producing Timber

		Comp. 30		Comp. 31		Comp. 32		Comp. 33		Comp. 34	
Seral Stage	Vegetation Type	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
1	High and Moderate Burned Areas	382	13.6	560	10.9	133	5.7	534	20.6	921	42.6
2 (shrub/seedling/ sapling)	1N/P	18	0.6	2	0.1	231	10.1	305	11.8	0	0.0
3A pole/medium trees, canopy 0-39%)	2S, 3S	685	24.4	1224	23.9	171	7.5	148	5.7	66	3.1
3B + C (pole/medium trees, canopy >40%)	2P,2N,2G,3P,3N,3G	1527	54.5	2719	53.3	535	23.3	1057	40.8	1141	52.8
4A (large trees, canopy 0-39%)	4S, 5S	0	0.0	0	0.0	13	0.6	0	0.0	0	0.0
4B + C (large trees, canopy >40%)	4P,4N,5P,5N	0	0.0	225	4.4	107	4.7	54	2.1	0	0.0
4C (decadent, large trees, canopy >70%)	4G,5G,6G	192	6.9	376	7.4	1104	48.1	490	19.0	33	1.5
TOTAL		2804	100.0	5106	100.0	2294	100.0	2588	100.0	2161	100.0

Appendix F TABLE 2-W

Alternative 2 - Created Diversity Levels By Acres and Percentages for NFS Lands Capable of Producing Timber

Seral Stage	Vegetation Type	Comp. 30 Acres	Comp. 30 Percent	Comp. 31 Acres	Comp. 31 Percent	Comp. 32 Acres	Comp. 32 Percent	Comp. 33 Acres	Comp. 33 Percent	Comp. 34 Acres	Comp. 34 Percent
1	High and Moderate Burned Areas	272	9.7	459	9.0	61	2.6	252	9.7	508	23.5
2 (shrub/seedling/ sapling)	1N/P	128	4.5	103	2.0	303	13.2	587	22.7	413	19.1
3A pole/medium trees, canopy 0-39%)	2S, 3S	685	24.4	1224	23.9	171	7.5	148	5.7	66	3.1
3B + C (pole/medium trees, canopy >40%)	2P,2N,2G,3P,3N,3G	1527	54.5	2719	53.3	535	23.3	1057	40.8	1141	52.8
4A (large trees, canopy 0-39%)	4S, 5S	0	0.0	0	0.0	13	0.6	0	0.0	0	0.0
4B + C (large trees, canopy >40%)	4P,4N,5P,5N	0	0.0	225	4.4	107	4.7	54	2.1	0	0.0
4C (decadent, large trees, canopy >70%)	4G,5G,6G	192	6.9	376	7.4	1104	48.1	490	19.0	33	1.5
TOTAL		2804	100.0	5106	100.0	2294	100.0	2588	100.0	2161	100.0

Appendix F TABLE 2-W

Alternative 3 - Created Diversity Levels By Acres and Percentages for NFS Lands Capable of Producing Timber

Seral Stage	Vegetation Type	Comp. 30 Acres	Comp. 30 Percent	Comp. 31 Acres	Comp. 31 Percent	Comp. 32 Acres	Comp. 32 Percent	Comp. 33 Acres	Comp. 33 Percent	Comp. 34 Acres	Comp. 34 Percent
1	High and Moderate Burned Areas	272	9.7	420	8.2	61	2.6	252	9.7	469	21.7
2 (shrub/seedling/ sapling)	1N/P	128	4.5	142	2.8	303	13.2	587	22.7	452	20.9
3A pole/medium trees, canopy 0-39%)	2S, 3S	685	24.4	1224	23.9	171	7.5	148	5.7	66	3.1
3B + C (pole/medium trees, canopy >40%)	2P,2N,2G,3P,3N,3G	1527	54.5	2719	53.3	535	23.3	1057	40.8	1141	52.8
4A (large trees, canopy 0-39%)	4S, 5S	0	0.0	0	0.0	13	0.6	0	0.0	0	0.0
4B + C (large trees, canopy >40%)	4P,4N,5P,5N	0	0.0	225	4.4	107	4.7	54	2.1	0	0.0
4C (decadent, large trees, canopy >70%)	4G,5G,6G	192	6.9	376	7.4	1104	48.1	490	19.0	33	1.5
TOTAL		2804	100.0	5106	100.0	2294	100.0	2588	100.0	2161	100.0

Appendix F

TABLE 2-W

Alternative 4 - Created Diversity Levels By Acres and Percentages for NFS Lands Capable of Producing Timber

		Comp. 30		Comp. 31		Comp. 32		Comp. 33		Comp. 34	
Seral Stage	Vegetation Type	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
1	High and Moderate Burned Areas	252	9.0	459	9.0	61	2.6	252	9.7	441	20.4
2 (shrub/seedling/ sapling)	1N/P	148	5.2	103	2.0	303	13.2	587	22.7	480	22.2
3A pole/medium trees, canopy 0-39%)	2S, 3S	685	24.4	1224	23.9	171	7.5	148	5.7	66	3.1
3B + C (pole/medium trees, canopy >40%)	2P,2N,2G,3P,3N,3G	1527	54.5	2719	53.3	535	23.3	1057	40.8	1141	52.8
4A (large trees, canopy 0-39%)	4S, 5S	0	0.0	0	0.0	13	0.6	0	0.0	0	0.0
4B + C (large trees, canopy >40%)	4P,4N,5P,5N	0	0.0	225	4.4	107	4.7	54	2.1	0	0.0
4C (decadent, large trees, canopy >70%)	4G,5G,6G	192	6.9	376	7.4	1104	48.1	490	19.0	33	1.5
TOTAL		2804	100.0	5106	100.0	2294	100.0	2588	100.0	2161	100.0

Appendix F

TABLE 2-W

Alternative 5 - Created Diversity Levels By Acres and Percentages for NFS Lands Capable of Producing Timber

		Comp. 30		Comp. 31		Comp. 32		Comp. 33		Comp. 34	
Seral Stage	Vegetation Type	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
1	High and Moderate Burned Areas	232	8.3	420	8.2	61	2.6	252	9.7	441	20.4
2 (shrub/seedling/ sapling)	1N/P	168	5.9	142	2.8	303	13.2	587	22.7	480	22.2
3A pole/medium trees, canopy 0-39%)	2S, 3S	685	24.4	1224	23.9	171	7.5	148	5.7	66	3.1
3B + C (pole/medium trees, canopy >40%)	2P,2N,2G,3P,3N,3G	1527	54.5	2719	53.3	535	23.3	1057	40.8	1141	52.8
4A (large trees, canopy 0-39%)	4S, 5S	0	0.0	0	0.0	13	0.6	0	0.0	0	0.0
4B + C (large trees, canopy >40%)	4P,4N,5P,5N	0	0.0	225	4.4	107	4.7	54	2.1	0	0.0
4C (decadent, large trees, canopy >70%)	4G,5G,6G	192	6.9	376	7.4	1104	48.1	490	19.0	33	1.5
TOTAL		2804	100.0	5106	100.0	2294	100.0	2588	100.0	2161	100.0

TABLE 2-W

Alternative 6 - Created Diversity Levels By Acres and Percentages for NFS Lands Capable of Producing Timber

Seral Stage	Vegetation Type	Comp. 30 Acres	Comp. 30 Percent	Comp. 31 Acres	Comp. 31 Percent	Comp. 32 Acres	Comp. 32 Percent	Comp. 33 Acres	Comp. 33 Percent	Comp. 34 Acres	Comp. 34 Percent
1	High and Moderate Burned Areas	197	7.0	415	8.1	61	2.6	252	9.7	441	20.4
2 (shrub/seedling/ sapling)	1N/P	203	7.2	147	2.9	303	13.2	587	22.7	480	22.2
3A pole/medium trees, canopy 0-39%)	2S, 3S	685	24.4	1224	23.9	171	7.5	148	5.7	66	3.1
3B + C (pole/medium trees, canopy >40%)	2P,2N,2G,3P,3N,3G	1527	54.5	2719	53.3	535	23.3	1057	40.8	1141	52.8
4A (large trees, canopy 0-39%)	4S, 5S	0	0.0	0	0.0	13	0.6	0	0.0	0	0.0
4B + C (large trees, canopy >40%)	4P,4N,5P,5N	0	0.0	225	4.4	107	4.7	54	2.1	0	0.0
4C (decadent, large trees, canopy >70%)	4G,5G,6G	192	6.9	376	7.4	1104	48.1	490	19.0	33	1.5
TOTAL		2804	100.0	5106	100.0	2294	100.0	2588	100.0	2161	100.0

APPENDIX G

APPENDIX G

United States
Department Of
Agriculture

Forest
Service

Hayfork RD

"QUALITY IN SERVICE AND RESOURCE MANAGEMENT"

DATE: October 7, 1987

REPLY TO: 2450 Sale Contract and Permits

SUBJECT: Fire Salvage Sales

TO: Team Leaders

OBJECTIVES

1. Our overall objective is to save as many live trees as we can in marking salvage. After considering the following guidelines, if uncertainty exists about a tree's chances for survival, leave it. It is not our intention to remove all trees that MIGHT die. We do want to capture as much predictable mortality as we can, however there will likely be a need to re-enter areas to salvage dead timber in future years. We do not have the capability to restock all burned areas if we remove all damaged but live timber at this time. There will no doubt be areas which will need future consideration for regeneration harvest as a result of salvage operations.

2. Sale size should generally be between 5 MMBF and 10 MMBF. Logical sale area boundaries are to be used and will dictate sale size. Some sales up to 15 MMBF may be required because of logical sale area boundaries and road systems.

3. During salvage operations we have to allow for continuing a small sales program also. Look for areas that lend themselves to SSTS sales of 1.5 MMBF or less and identify them as such. (Tractor ground).

GUIDELINES - The following applies to all burned areas:

1. Planning groups for each area will:

   a. Each team will take assigned fires from planning through contract package.

   b. Determine which logging system to use within current accepted practice and guidelines.

   c. Designate on the ground and map areas to be clearcut or ITM salvaged. Stocking or understocking of remaining stands will not be a criteria for designating a unit for clearcutting.

If there are more trees dead than alive, designate as clearcut and mark trees to be saved within the unit with "SAVE".

If there are more trees alive than dead, designate as ITM unit and mark trees to be cut.

In tractor units, save all live trees.

In cable or helicopter units, save all live trees consistent with resource needs, safety, logging practicality and economics. Consider factors such as natural regeneration, economics of artificial regeneration, logical management units, etc.

d. Identify follow-up treatments such as site prep, release for establishment, etc.

e. Cruising is not required. Hayfork District has cruise information from within or adjacent to burned areas to determine volumes. When marking in ITM units, a tree count by species is necessary to calculate volumes.

f. List SMZ requirements and needed mitigation measures. Include recommendations and requirements outlined in approved Emergency Fire Rehabilitation Plans. Use General Guidelines for Watershed Management in Burned Areas as a guide. (Copy attached).

g. Additional Wildlife guidelines and mitigation requirements are outlined in Fire Restoration Wildlife Report attached.

2. The following guidelines are a simplification of those found in PSW Miscellaneous Paper 60. They are tempered with our desire to retain as much live timber as possible.

a. Cut tree mark all merchantable trees with any of the following characteristics:

PONDEROSA PINE -

Harvest trees with less than 20% of their prefire live crown remaining. (Green foliage)

Harvest trees having dead cambium surrounding more than 40% of their circumference.

SUGAR PINE -

Harvest trees with less than 30% of their prefire live crown remaining. (Green foliage)

Harvest trees having dead cambium surrounding more than 60% of their circumference.

DOUGLAS-FIR, TRUE FIR, INCENSE CEDAR -

Harvest trees with less than 30% of their prefire live crown remaining. (Green foliage)

Harvest trees having dead cambium surrounding more than 40% of their circumference.

b. General rules.

Ponderosa Pine can survive more crown damage than can fir, cedar or Sugar Pine.

Sugar Pine can survive more cambium damage than any other species.

Check exposed roots for hot burn and lower bole cambium kill at or below ground level.

Lower survival standards for live cull trees. (Leave them standing unless resource needs dictate otherwise.)

The planning group will mark with marking crews at first to establish our overall objectives and will periodically check marking after crews are on their own.

DESIGNATION OF TIMBER TO BE CUT IN BURNED AREAS

All areas other than within clearcut unit boundaries shall be ITM marked by marking only those trees that are to be cut. DO NOT USE LEAVE TREE MARKED UNITS.

Clearcut unit boundaries shall be flagged and painted intervisible but no further than one chain intervals. (Additional units within sales under contract will use blue and yellow flagging). Unit boundaries will be designated with "X X X" painted vertically on trees with one "X" below stump height. It is preferred to flag and paint non-commercial trees (except Madrone) to maintain the boundary after felling. Merchantable trees on or near the unit boundary to be cut will be painted vertically with "C C C". One "C" shall be below stump height. Trees to be saved within Clearcut units will be designated by painting "SAVE". Color of paint and flagging to be used will be assigned by team leader who will coordinate with Hayfork Prep. Forester.

Post all four unit corners with "Clearcut Boundary" signs or equivalent and paint Unit number. Identify: sale name, unit # and corner (NE, SW, etc.). Signs will face into the unit and be put on non-commercial trees if possible. Signs and painted unit number will also be placed at existing or proposed road crossings.

The Hayfork District will furnish all flagging, paint, and boundary signs. The following flagging combinations are available for unit boundaries: blue, yellow, blue & orange, blue & white, blue & yellow, and orange & yellow. The following paint colors are available for use: blue, yellow, white, and orange.

Do not use blue paint or blue only flagging in or adjacent to areas that have current sales prepped not sold or sales under contract. Do not use blue & yellow flagging in or adjacent to sales under contract.

FINAL NOTES

1. There will be some small areas within salvage units which will become clearcuts after salvage. Note these areas on a map and estimate acreage.

2. Take notes on meadows, sensitive areas, unstable areas, SMZ recommendations or any information which might be useful.

3. Revise KV and BD plans.

/s/ Mary Smelcer
Mary Smelcer
Assistant District Ranger

APPENDIX H

APPENDIX H

PUBLIC INVOLVEMENT/PARTICIPATION ACTION PLAN

SOUTH FORK FIRE RECOVERY/SALVAGE PROJECT EIS

PHASE I of this Plan represents public involvement conducted in October - December of 1987 for proposed fire recovery and salvage opportunities on the Hayfork Ranger District of the Shasta-Trinity National Forests. For more information reference the document entitled "Public Input Content Analysis - Hayfork Salvage/Restoration 1987" on file at the Supervisors Office, Shasta-Trinity National Forests, 2400 Washington Ave., Redding, CA 96001; and at the Hayfork Ranger District Office, Hayfork, CA 96041.

The results of this public involvement, along with PHASE II described below, will be incorporated into the analysis of public input to develop issues/concerns/opportunities for an Environmental Impact Statement for the South Fork area.

PHASE II of this Plan is the public involvement conducted for an EIS for resource recovery and salvage opportunities in the former South Fork roadless area released for multiple-use purposes.

PHASE I

ACTION	WHO	WHEN
Issue news release to media (Trinity Journal and Record Searchlight) announcing public meetings at Weaverville (10/15/87), Hayfork (10/16/87) and Hyampom (10/19/87); and soliciting issues/concerns/opportunities for potential restoration and salvage harvest of fire damaged timber. Input requested by 10/28/87.	Hayfork Rgr. Dist.	10/9/87 Trinity Journal 10/15 Edition Record Searchlight 10/15 Edition
Send letter to key publics and agencies announcing public meetings and soliciting input. Input requested by 10/28/87.	Hayfork Rgr. Dist.	10/9/87
Notice of public meetings and solicitation of public input posted in Hayfork and Hyampom post offices.	Hayfork Rgr. Dist.	10/13/87
Conduct public meetings.	Hayfork Rgr. Dist.	10/15/87 (Wville) 10/16/87 (Hayfork) 10/19/87 (Hyampom)
Update mailing list.	Hayfork Rgr. Dist.	10/21/87
Letter to interested publics inviting them to attend a "training session for salvage markers" on 11/6/87.	Hayfork Rgr. Dist.	10/30/87
Complete content analysis.	R. Mannion	Nov. /87
Media news release announcing an "Open House" at the Hayfork Ranger District Office on 12/18/87 to inform the public of fire mortality and restoration/salvage opportunities within the former South Fork roadless area released for multiple-use purposes.	Hayfork Rgr. Dist.	12/11/87

PHASE II

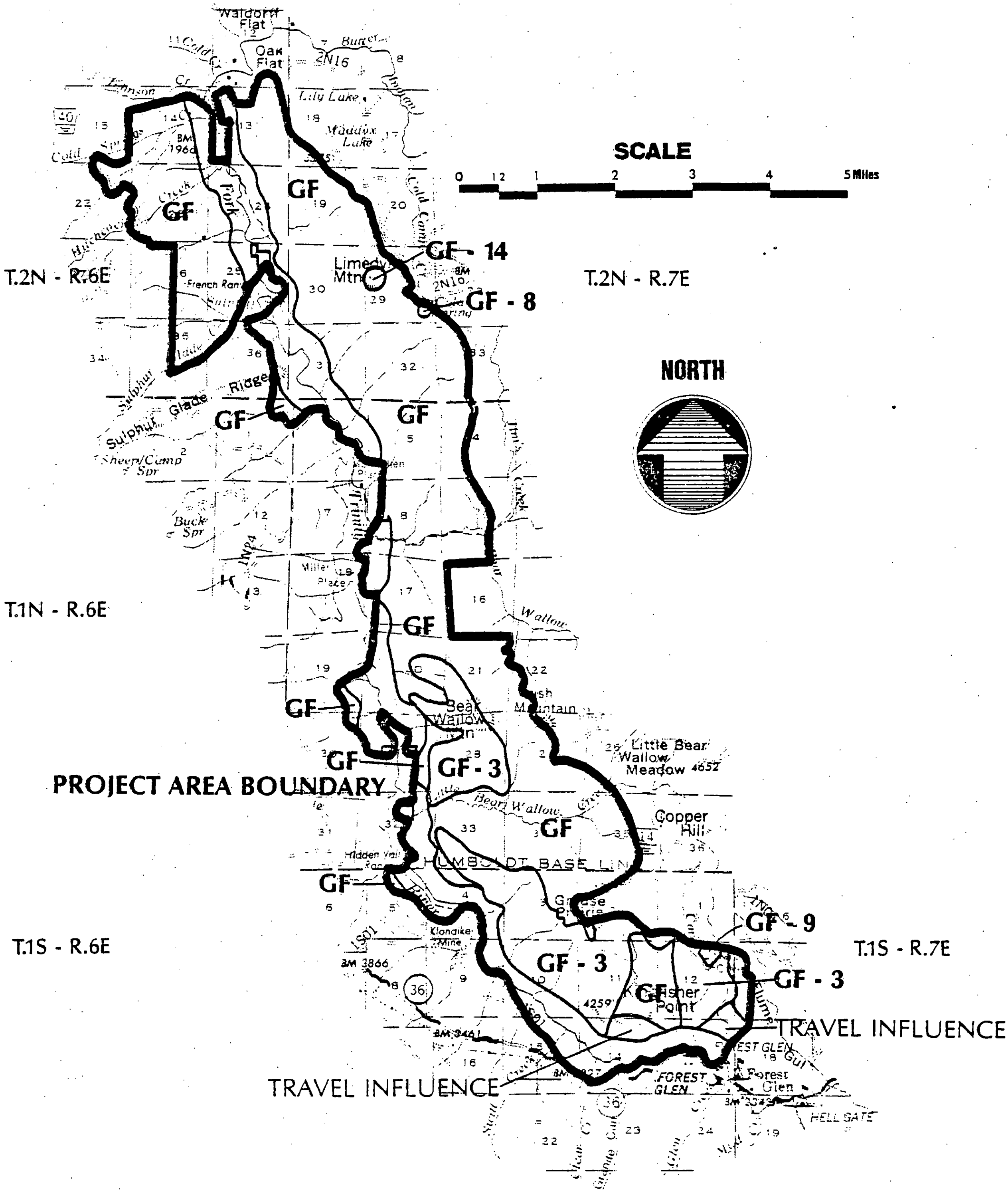
ACTION	WHO	WHEN
Prepare Notice of Intent (NOI) for the Federal Register to be published March 10, 1988.	SO	3/4/88
Issue news release to media (Record Searchlight and Trinity Journal) soliciting comments as part of the scoping process.	SO, PIC	3/7/88
Arrange for public meetings at Hayfork, Weaverville, and Hyampom.	PIC	3/7/88
Update mailing list of interested individuals, appropriate agencies, community representatives, and organizations.	PIC	3/8/88
Mail letters to those on mailing list to announce public meetings and solicit public comments as part of the scoping process.	PIC	3/9/88
Post a copy of news release in the Hayfork and Hyampom post offices to announce public meetings and solicit public comments as part of the scoping process.	PIC	3/9/88
Request to EPA (Dir. of Office of Federal Activities) to waive the 30 day requirement from the filing of FEIS in the Federal Register before a decision can be made.	RF	4/88
Arrange for a public meeting in Redding.	PIC	3/16/88
Notify the California State Clearinghouse of the preparation of the EIS.	PIC/SO	3/18/88
Letter of consultation to U. S. Fish and Wildlife Service and the California Dept. of Fish and Game.	PIC	3/23/88
Conduct public meetings.	IDT	3/22/88 (Weaverville) 3/23/88 (Hyampom) 3/24/88 (Hayfork) 3/25/88 (Redding)
"Progress Report" on EIS sent to those on mailing list.	PIC	3/29/88

Date for receipt of public input to be most effective in the analysis.		4/1/88
Update mailing list from written comments received.	PIC	4/2/88
Complete content analysis.	PIC	4/4-7/88
Purge mailing list to ascertain those desiring a copy of the draft EIS and/or Summary.	PIC	4/14/88
Issue Notice of Availability of DEIS to EPA for publishing in the Federal Register.	PIC, SO	5/23/88
Send the DEIS or Summary to those requesting a copy.	IDT	5/23/88
Issue a news release to the media announcing the availability of the DEIS for public review.	PIC, SO	5/23/88
Publish Notice of DEIS in Federal Register	EPA	6/3/88
Conduct an Open-House meeting for the DEIS.	IDT	6/22/88
Complete content analysis of comments received from the public review of the DEIS.	PIC	7/18-22/88
Issue Notice of Availability of FEIS to EPA for publishing in the Federal Register.	PIC, SO	8/16/88*
Issue Record of Decision (ROD) and FEIS.	FS, TL	8/16/88*
Issue news release to the media on the ROD. Send notice of the decision made to those on the mailing list.	PIC, SO	8/24/88*
Public Notification of Decision by paid Ad to Trinity Journal	FS	8/24/88*

<u>Legend</u>:

PIC: Public Information Coordinator
SO: Supervisors Office
TL: Team Leader
FS: Forest Supervisor
IDT: Interdisciplinary Team
RF: Regional Forester
* : Dates are approximate

APPENDIX I



MULTIPLE USE MANAGEMENT ZONES
SOUTH FORK FIRE RECOVERY/SALVAGE PROJECT

APPENDIX J

A P P E N D I X   J

SOUTH FORK RECOVERY/SALVAGE ENVIRONMENTAL IMPACT STATEMENT

GEOLOGY, SOILS, HYDROLOGY AND FISHERIES RESOURCES

HAYFORK RANGER DISTRICT, SHASTA-TRINITY NATIONAL FORESTS

August 11, 1988

Donald M. Haskins, Forest Geologist
Richard A. Irizarry, Forest Fisheries Biologist
Abel Jasso, Geologist
Kenneth E. Lanspa, Forest Soil Scientist
Darrel W. Ranken, Forest Hydrologist

PHYSIOGRAPHY

The project area is located adjacent to the main stem of the South Fork Trinity River, the largest tributary to the Trinity River. It drains about one-third of the total area of the Trinity basin (Hubbell, 1973, p. 3). With its headwaters in the Yolla Bolly Mountains at an elevation of 5,800 feet, the South Fork Trinity River flows in a narrow streambed through dense forests in the upper reaches, and a broad devastated flood plain further downstream. Massive landslides are common along the river corridor. The stream is free-flowing and man-made intrusions are minimal (Huddleson, 1983).

The project area generally lies below the western rim of a portion of a large upland area. The heart of the upland area is characterized by relatively low gradient, erodible stream channels and relatively stable, gentle sideslopes. In contrast, the western perimeter, which descends rapidly into the South Fork Trinity River, is characterized by deeply dissected tributaries, having steep, bedrock controlled channels and relatively steep and unstable sideslopes.

The project area is approximately 17,200 acres in size, and extends from river mile 38, in the vicinity of French Ranch, to river mile 56, near the village of Forest Glen. The project area reaches to the rim of the canyon, and encompasses minor portions of the upland area within headwaters of some watersheds. Elevations range from 1490 feet at river mile 38 to 2320 feet at Forest Glen. Elevations at prominent peaks along the canyon rim are 4810 at Irish Mountain, 4850 at Bear Wallow Mountain and 4720 at Limedyke Mountain. Prominent watersheds, from north to south, include Plummer Creek, Little Bear Wallow Creek, Bear Wallow Creek, Kingfisher Creek and Cave Creek. In addition, a host of unnamed, minor streams are present within the project area which originate at the canyon rim, and descend steeply into the South Fork Trinity River.

GEOLOGY

GEOLOGIC SETTING

The project area is located within the Klamath Mountain geomorphic province. This province is a west-facing arcuate region at the boundary between northwestern California and southwestern Oregon. It consists predominantly of marine arc-related volcanic and sedimentary rocks of Paleozoic and Mesozoic ages. Ultramafic and associated ophiolitic rocks are also important components. Granitic plutons intruded many parts of the province during Jurassic time. Structurally, the province consists of a series of north to northwest trending slices of ancient crust that form an imbricate eastward dipping sequence.

The province is the product of tectonic accretion of fragments of oceanic crust and island arcs. Paleozoic rocks of the eastern Klamath region formed a nucleus against which other tectonic slices later accreted. The nucleus was a long-standing arc, built on a dominantly ultramafic base, and shows evidence of intermittent volcanism ranging from early Paleozoic into the Jurassic.

A layer of amphibolite and mica schist developed probably as a result of subduction of the more westward oceanic rocks. Although the record of volcanism in the eastern Klamath region suggests that subduction took place during the late Paleozoic and early Mesozoic, no acretion to the eastern Klamath nucleus seems to have occurred between the Devonian and Jurassic. The various tectonic slices of the western Klamath Mountains were swept against the Paleozoic nucleus only during Jurassic time.

The province has been subdivided into several lithotectonic units that from east to west are called the Eastern Klamath belt, the Central Metamorphic belt, the Western Paleozoic and Triassic belt, and the Western Jurassic belt. The project area lies within the latter two geologic belts.

The Western Paleozoic and Triassic belt is the most extensive of the concentric lithic belts. The southern part of the Western Paleozoic and Triassic belt has been divided into three parallel subunits called terranes. From east to west these are the North Fork, Hayfork, and Rattlesnake Creek terranes. The term "terrane" refers to an association of geologic features, such as stratigraphic formations, intrusive rocks, mineral deposits, and tectonic history, some or all of which lend a distinguishing character to a particular tract of rocks and which differ from those of an adjacent terrane.

The Western Jurassic belt is exposed as a narrow belt along virtually the entire length of the western limit of the Klamath Mountain province. It consists of a stratigraphic section of flysh and volcanic-arc deposits of the Galice and Rogue Formations, and includes the Josephine Peridotite and related ophiolitic rocks which is the basement layer of the belt. On the west it is bordered (in California) generally by the South Fork Mountain Schist, a narrow belt of regional blueschist of Early Cretaceous age, which is the easternmost formation within the California Coast Ranges.

BEDROCK GEOLOGY

The main subunit within the Western Paleozoic and Triassic Belt encountered within the project area is known as the Rattlesnake Creek Terrane. The main subunits within the western Jurassic belt is the Galice Formation and the Glen Creek Ultramafic Complex.

Western Paleozoic and Triassic Belt - Rattlesnake Creek Terrane

The Rattlesnake Creek terrane is exposed for a length of 90 miles and a width that ranges between 6 and 9 miles. For most of its length it is bordered to the east by the Hayfork terrane and to the west by flysh of the western Jurassic belt. The terrane consists of a wide variety of rocks, including abundant ultramafic rock, gabbro, diabase, pillow basalt, chert, various mafic volcanic rocks, granite, limestone, phyllite, sandstone, and conglomerate. Plutons of diorite (such as the Bear Wallow Diorite Complex encountered within the project area) are sparsely scattered throughout the terrane. The rocks are greatly disrupted by folding and faulting, and their original relations are further obscured by widespread slope failure and landsliding. Lithologies suggest that much of the terrane is a dismembered ophiolite. Intermixing of the various rocks indicates that the terrane is a melange.

The characteristic manifestation of these varied rock types is that of allochthonous blocks ranging in size from a few acres to hundreds of acres. When a crustal plate is underthrust it is intensively faulted and tremendous mixing of fault blocks occur. These blocks are separated by a matrix of highly sheared serpentine-rich fault gouge. In a sense, these blocks are floating in this matrix. This type of terrane is thus termed a melange.

The following section will deal with specific rock types within the Rattlesnake Creek terrane as mapped within the project area.

Metasediments

The most common metasediment in the terrane is a fine-grained phyllite. This rock type is generally found within the extreme western portion of the project area. Phyllites are interbedded with competent sandstones which have been strongly recrystalized. These sandstone bodies are resistant to weathering and mass wasting and stand out as prominent knobs along ridgetops and within the small block melange zones.

The least abundant of the metasediments are conglomerates. Pebble conglomerates are generally associated with the sandstones and are similar in character. They are also competent and resistant to weathering and mass wasting.

Limestone blocks occur sporadically throughout the Rattlesnake Creek terrane. These can range in size from a few yards across up to large blocks that may reach hundreds of yards in lateral extent, such as the Marble Caves area. Several large blocks occur as inclusions within interbedded chert, argillite and tuff that likewise occur as tectonic fragments within melange.

Metavolcanics

Both small and large blocks of metavolcanic rocks are found throughout the terrane which constitutes the extreme western portion of the project area. Prominent rock types include basaltic breccia, basaltic flows, pillow basalts, and both coarse and fine-grained tuffaceous sediments. The character of these rocks varies considerably throughout the terrane in their distribution, association, and grain size, This group of rocks is generally quite massive in expression and resistant to weathering.

Small Block Melange

Areas underlain by small block melange are quite distinctive. Due to the contrast in properties between the sheared matrix and the resistant blocks, there is a distinct lack of structural and geomorphic coherence. Drainage networks developed within these areas are poorly organized and highly variable in characteristics such as gradient, width and density. The terrain has a very "flowing" character, resembling an earthflow with solid resistant blocks sticking up through it. Only one type of small block melange has been delineated within the project area; serpentine melange.

Serpentine melange is characterized as being composed of small blocks, less than 50 acres in size, of all the previously discussed rock types which are bounded by large areas of serpentine-rich matrix. This zone generally lacks compentency although some of the more resistant bedrock blocks stand out as "knockers". Lithologic variability is tremendous within this unit, changing on an acre by acre basis.

The unsheared masses of coherent rock embedded within the melange matrix may have high to very high strength characteristics, although they may rarely show evidence of continuity between outcrops. The intensely sheared melange matrix that encloses the coherent rock masses is inherently weak and is moderately erodible. Additionally, this matrix commonly weathers to clay-rich, highly expansive soils; soils that swell when wet and shrink when dry. These soils creep downslope as a result of the swelling and shrinking process and low shear strength, and thus contribute to the formation of landslides.

The matrix, being the weakest component, controls the overall stability of slopes underlain by the melange. The sharp differences in inherent strength characteristics of various components of the melange result in irregular topography and highly diverse slope stability characteristics.

The potential for slope failure is increased by past differential movement along shear and fault zones; by the introduction of water into the matrix, which decreases shear strength of the crushed material; and by the removal of vegetation that destroys the network of roots binding weak soil materials together. Small block melange is found in locations south and west of Limedyke Mountain and northwest of Irish Mountain.

Intrusive Complex

Within the project area, the most widespread rock type in the Rattlesnake Creek terrane is known as the Bear Wallow Diorite Complex (Irwin, 1985). It is located in the western portion of the project area from approximately south of Little Bear Wallow Meadow to the South Fork Trinity River, in a narrow longitudinal belt about one to two miles wide.

The complex is one of several relatively large tectonic blocks composed primarily of gabbroic to leucodioritic rocks exposed within the western part of the Rattlesnake Creek terrane. All of these blocks have tectonic and not plutonic contacts with the surrounding undifferentiated melange. Based upon their composition, textural heterogeneity, and their occurrence as tectonic blocks associated with other elements of the ophiolite suite, Wright (1981) has interpreted them to be the static upper plutonic complex of oceanic crust.

Western Jurassic Belt - Galice Formation

This formation, along with the Glen Creek Ultramafic Complex, occupies the western two-thirds of the project area. Within the project area this formation consists of phyllite and semischist. It is separated from the Rattlesnake Creek Terrane to the north and east by a sharp, eastward dipping, northwest trending fault known as the Bear Wallow fault. This fault runs from Forest Glen northwest to the approximate vicinity of Limedyke Mountain within the project area.

Relict bedding strikes west-northwest and dips to the northeast at 45 to 50 degrees. Foliations trend northwest with a shallow plunge to the east. Jointing is highly variable with no consistent orientation noted.

Glen Creek Gabbro-Ultramafic Complex

Also identified is a unit known as the Glen Creek Gabbro-Ultramafic Complex. This complex intrudes and metamorphoses strata of the Galice Formation within the southern portion of the project area from Little Bear Wallow Creek to south of Forest Glen. The complex consists primarily of peridotite, which tends to occupy a central core zone, and an outer zone of gabbro (Wright, 1981). This area seems to have affinities with the concentrically-zoned ultramafic complexes that intrude the western Hayfork terrane.

Immediately to the west of the project area is encountered the South Fork Mountain Schist, which regionally comprises the easternmost formation within the Coast Range Province. The South Fork Mountain Thrust Fault, which separates the provinces, is regional in extent. The fault trends northwest and dips steeply eastward. It is located immediately west of the South Fork of the Trinity River. The fault is typically a one-thousand foot wide zone of intense shearing which contains local bodies of serpentinite, diorite dikes, Galice metasediments, and schist.

GEOMORPHOLOGY

An overview of the geomorphic processes and resulting features within this area indicates that mass wasting has played a dominant role in shaping the slope topography. The immense erosion rates resulting from mass wasting in conjunction with tremendous tectonic uplift rates has had a marked influence on the fluvial geomorphology of the area. Additionally, bedrock characteristics within the various geologic terranes have been important in the formation of local drainages.

In looking at the general geomorphology of the area it is apparent that mass wasting features cover nearly 80 percent of the landscape. Areas at the edge of the upland area erode dominantly through translational processes, while the lower slopes are more prone to debris slide processes. This is probably related to the soil development along the rim of the upland compared to the shallow soils developed on the canyon slopes.

Active debris slides and translational/rotational landslides are most apparent at the upland/canyon interface. These areas are dominantly underlain by Rattlesnake Creek terrane, Galice Formation and Glen Creek Complex. Due to the heterogeneous mix of bedrock types at this interface channel gradients change radically from reach to reach as resistant bedrock bodies lie within non-resistant zones, forming cascades with intervening low gradient stretches.

Mass Wasting Features

Translational-Rotational Landslides

This type of slide is defined as one which moves as a coherent or semi-coherent mass along a concave (rotational) or planar (translational) failure plane. This type of slide is not restricted to the zone of weathering, but can have deeply lying failure planes.

Translational-rotational landslides are morphologically divisable into four parts: 1) the crown scarp which is the headward zone of detachment, (2) lateral scarps (the lateral zone of detachment) (3) slide bench (the relatively flat lying portion of the displaced slide mass) and (4) the toe zone (the steep area at the base of the slide mass which extends down to where the failure plane intersects or "daylights" the slope).

The slide mass characteristically moves as a coherent body, and generally has relatively low movement rates. Movements generally occur in the winter and spring when moisture content is high.

Translational-rotational slides occur in all geologic rock types, but are especially common within the Rattlesnake Creek Terrane. Most slides occur in association with at least one of the following: serpentinized shear zones, faults, lithologic contacts, wet steep zones such as inner gorges, or (predominantly within the Galice Formation) north to northeast facing slopes. Where two or more of these factors are present the size or quantity of slide activity can be significantly increased, such as where the Bear Wallow fault traverses Plummer, Bear Wallow and Little Bear Wallow Creeks, and the Limedyke area.

Debris Slides and Debris Avalanches

These types of landslide generally are confined to the shallow soil or colluvium zone. The failure surface generally corresponds to the bedrock/soil interface and usually is no deeper than fifteen feet. Generally, debris slides have slump blocks at their head, with the slide mass becoming more broken toward the foot of the slope. Movement rates are slow to moderate. Debris avalanches, however, commonly fail rapidly, with the slide mass liquifying in part as it moves downslope. Failures often occur within low-order stream reaches or adjacent to higher-order stream channels. The preponderance of debris avalanches occur near the head of natural zero-order drainages (colluvial hollows), sometimes represented only by subtle inflection on the slope. Thusly, it is the more subtle features which can be the most hazardous. The scars characteristically are long and narrow in shape. Debris slides and avalanches generally occur in response to significant precipitation events.

Within the Galice Formation, debris slide-prone features are common mass wasting features especially along south and southwest facing slopes.

Debris Torrents

Debris torrents are a type of debris flow common in low-order mountain channels. They are defined as a rapid movement of water-charged soil, rock and organic material down high gradient stream channels. They are generally initiated during extreme discharge events when a streamside debris avalanche enters a channel and entrains organic debris and sediment through scouring as it moves downstream. The torrent continues to flow and scour until it reaches a lower gradient stream reach or meets a significant obstruction. When its momentum is lost, the slide material is deposited within the channel. The torrent deposit is usually downcut and slowly winnowed of its fine-grained silt, sand, gravel and organic components which are transported further down channel. The coarser-grained cobbles, boulders, and organic material remain as a lag deposit within and along the channel. This material can stabilize, revegetate or be re-entrained by later torrents. Debris torrents are common features within high gradient tributary streams of the project area especially within Kingfisher Creek, Cave Creek, Devil's Kitchen and the Limedyke areas. Many of these have occurred within the last 500 to 1,000 years.

Timber harvest activity, especially when large areas are involved, has a significant effect on the occurrence of debris torrents through slash accumulations in channels, increased peak discharges, culvert failures, fill failures, and disturbance of steep streamside areas leading to the increased occurrence of debris avalanches into stream channels.

Internested Translational-Rotational Slides

Internested translational-rotational slide areas are commonly found in areas overlain by cohesive soils. Typically they consist of individual slides having volumes ranging from 1,000 to 50,000 cubic yards which occur side by side, above, below and on top of one another over a broad area. Creep indicators such as "swept" and "jackstrawed" trees are commonplace. In the higher hazard types, springs and bogs occur.

As already mentioned, bedrock and structural properties such as downslope oriented bedding or foliation, shear and fault zones or melange areas are often responsible for the occurrence of widespread internested areas. Small block serpentine melange zones within the Rattlesnake Creek terrane and north to northeast facing slopes within the Galice Formation are most noted for these features.

Earthflows

Earthflows are relatively slow moving masses of clay-rich materials. These failures are complex, involving many components of different types of mass movement. In general, earthflow movement occurs during the winter and spring where, under fully saturated conditions, pore water pressures are elevated and intergranular resistance is reduced. High clay content increases the cohesiveness of the material. Failure planes are generally shallow (less than 50 feet) with movement rates ranging from gradual to periodic pulses of rapid movement.

Sediment is usually transferred to the fluvial system near the distal end of the earthflow where channels have developed. Channel stability in the form of bank failure, active headcuts, and lateral gullies is common at the distal portion of most earthflows. Earthflow movement rates are sometimes rapid enough to cause channel abandonment and migration on an annual basis.

Earthflows are minor in areal extent with the project area and are found mostly within serpentine melange bedrock units.

Valley Inner Gorges

A valley inner gorge is defined as the slope adjacent to a streamcourse having a slope gradient greater than sixty-five percent which is separated from the upslope area by a pronounced break in slope. Valley inner gorges are formed through channel downcutting, producing an oversteepened slope which periodically fails through debris slides, avalanches or translational-rotational slides that "toe out" in the inner gorge. Active slides are common in these areas.

Valley inner gorges are found throughout the project area, but proportionately, they are present within only a small percentage of the land area. Active slides within an inner gorge contribute significant quantities of sediment directly to the fluvial system.

The depth of the inner gorge can range from 25 up to 400 feet along the South Fork Trinity River. Sideslopes vary from 60 to 110 percent. Along the South Fork of the Trinity alluvial terraces commonly stand as high as 150 feet above the present river level.

Tributary inner gorge zones often extend to mid and upper slope into the second-order tributaries. Incisement is not as deep at midslope however the sideslopes remain characteristically steep. Typical depths of the tributary inner gorges range from 50 to 150 feet.

SLOPE STABILITY HAZARDS

Slope stability hazards within a major portion of the project area are considered to range from low to extreme, according to the geologic and topographic conditions previously characterized.

The mass wasting features were analyzed through photo-interpretation techniques and reconnaissance field study in order to evaluate the potential for them to be activated by proposed management activities regardless of the possible mitigating measures that may be employed. This is a subjective, relative evaluation meant only to compare different mass wasting features within the project area and is not meant as a site specific tool.

Extreme hazards are defined for all active slides, regardless of their type. Active areas are found throughout the project area but the largest are found in the Limedyke Mountain area and the Plummer, Bear Wallow, and Little Bear Wallow Creek areas. Most of these active slides are associated with a combination of several factors such as proximity to faults, lithologic contacts and inner gorges. These areas should be considered highly vulnerable to re-activation.

High to extreme hazards are defined for all valley inner gorges. Major inner gorges exist in the South Fork, Plummer, Bear Wallow and Little Bear Wallow Creeks. The area where the stream channel evolves to an inner gorge profile also has a relatively high stability hazard. This area marks the point of headward migration of the tributary inner gorge through debris sliding, debris avalanching, and debris torrents. The upslope migration of the tributary inner gorge is an on-going geologic process. The migrational process is active in many of the tributary streams of the aforementioned streams. Considering the presence of active debris avalanches and rotational slides and the abundance of dormant slide features which have a low factor of safety, these zones should be considered highly sensitive to management practices. These features are therefore assigned a hazard level of high to extreme.

Moderate to high hazards are defined for areas within debris avalanche/slide features, nested translational-rotational areas (especially within small block melange terrain), toe zones of large translational landslides (especially where traversed by the Bear Wallow Fault), and, within the Galice Formation, north and northeast facing slopes. Within these areas it is judged that there is a relatively high probability of initiating some 1,000 to half-million cubic-yard landslides through intensive management.

Low to moderate hazards are defined for crown scarp areas of translational-rotational type landslides, most debris slide prone slopes and the upland area of the Bear Wallow Diorite Complex. Perennial streams are common in these areas and ephemeral channels also carry significant seasonal flows. Most mass wasting processes are presently dormant and should remain so until the inner gorge zone migrates into these areas. Within these areas there is a risk of initiating 100 to 1,000 cubic-yard debris avalanches or rotational landslides through intensive management.

The fires have had an influence on slope stability within the project area. The two variables affected by fire that contribute to slope instability are loss of root support and increased groundwater due to tree mortality. Shallow seated mass wasting features such as small translational slides and debris slides rely on root support for stability. In addition, root support is critical in certain zones of larger landslide complexes, often limiting seasonal slide movement to relatively low rates due to the roots interlocking laterally, providing some shear strength. Loss of root support on some of these landslide features will result in increased instability over the next few years as the root masses decompose and lose their strength. Increased groundwater levels are probably not as significant in contributing to mass wasting, except perhaps for some inner gorges where large areas upslope were denuded of vegetation. Local areas most prone to fire induced landsliding are in the Limedyke area and adjacent to the inner gorges of Cave and Kingfisher Creeks. No slopes directly adjacent to the South Fork Trinity River are considered at high risk.

The remainder of the study area appears to have no identified instability. It should be noted, however, that this analysis method is generalized. The possibility thus exists of differing hazard levels occurring within these general zones.

SOILS

The soils within the study area have developed primarily from metasediments, metavolcanics and phyllites, along with minor bodies of diorites, ultramafics and limestone. The soil types are closely tied to the topography. In general, soils on gentle slopes are well developed, deep and non-rocky. As the slopes steepen, the soils become shallower and rockier with rock outcrops becoming more prevalent. In large measure, the area can be described as having very steep slopes, with shallow soils which are non-commercial to marginally commercial for timber production.

Table 1 is a list of soils and their characteristics which have been identified in the project area:

TABLE 1 - SOIL CHARACTERISTICS WITHIN PROJECT AREA

SOIL OR MAPPING UNIT	CHARACTERISTICS
Rock Outcrop	Metasediments, phyllites, diorite, metavolcanics and limestone.
Typic Xerorthents	Moderately deep (20 to 40 inches) to deep (greater than 40 inches), loan textures, and 80 to 90% rock fragments. Available waterholding capacity (AWC) is 0.2 to 1.0 inches.
Deadwood	Shallow (less than 20 inches), loam textures, 40 to 70% rock fragments. AWC is 0.9 to 1.7 inches.
Neuns	Moderately deep, loam textures, 40 to 70% rock fragments. AWC is 1.3 to 3.2 inches.
Marpa	Moderately deep, clay loam textures, 40 to 60% rock fragments. AWC is 1.6 to 3.3 inches.
Speaker	Moderately deep, clay loam textures, 10 to 30% rock fragments. AWC is 2.7 to 4.1 inches.
Hotaw	Moderately deep, sandy clay loam textures, 10 to 30% rock fragments. AWC is 2.4 to 4.3 inches.
Madonna	Moderately deep, clay loam textures, 10 to 30% rock fragments. AWC is 2.3 to 3.5 inches.
Serpentine Soils	In large measure devoid of vegetation.

FIRE EFFECTS

Soil surface temperatures during wildfires and prescribed burning varies widely depending on the climatic conditions, slope, fuel type and quantity. Studies indicate that during the dry season, woody fuels can be ignited at temperatures ranging from 500 to 750^{o}F (Lanspa, 1974). Flame temperatures may reach over 3000^{o}F, however, at the soil surface temperatures rarely exceed 1400^{o}F. Soils have a low heat conductivity, which results in a rapid drop in temperature with depth. For example, it has been reported that soil surface temperatures from a fire of high burn intensity in logging slash, can range from 600 to 1200^{o}F. At 1 inch below the surface, the temperature is around 300^{o}F, and at 3 inches the temperature can be expected to be around 150 ^{o}F. Therefore, with the exception of severe burns, the soil humus remains unaffected and the soil undamaged.

Light burns are those where the duff is scorched. Moderate burns are those where the duff is charred without visible altering of the underlying soil. In hot burns the duff and small twigs are consumed and turned to a white ash. There may be some alteration of the top 1/4 inch of the mineral soil. Within moderate and high intensity burn areas, some localized, severe burning may occur. Where severe burning occurs, the duff, small branches and stems are burned to a white-ash and the topsoil is oxidized to a brick red color. The depth of this oxidation is more dependent on the length of time the soil was subjected to heating, rather than to the intensity of the heat. Therefore, severe burns are likely to be found under large logs or large concentrations of slash.

Burn intensities are related to flame length and rate of spread; as the rate of spread and flame length increase, burn intensities increase. Hence, there frequently will be no relationship between fuel burning intensities in forest fires and burning intensities associated with soils.

The loss of duff in hot burns can effect the long term soil productivity through nutrient loss, as well as, exposing the soil to erosion. Severe burns destroy the humus and the structure within the soil. Loss of structure will significantly increase the erodibility of the soil.

Researchers studying slash burning have found that severe burns rarely exceed 3% of the area. There is little information on wildfires. However, it stands to reason that wild fires in standing timber will have less of an effect on the soils because of generally lower fuel loads than in slash burns. Within the project area, it is estimated that less than 1% of the soils were severely burned, 5% hot, 35% moderate, 20% light burn and 40% was not burned at all.

Studies show that soil pH increases after a burn (Lanspa, 1974). The amount of increase is dependent on the intensity of the burn and the amount of slash and organic matter consumed. The pH increase is an indicator that plant nutrients and other elements have been released from organic material as a result of burning.

The following Soil Legend (Table 2) identifies the mapping units delineated on the Soils Map, as well as management interpretations associated with those mapping units:

TABLE 2

		EROSION HAZARD	REGENERATION POTENTIAL
1	Rock Outcrops	-----	--------
2	Rock Outcrops/Deadwood	LOW	V. POOR
3	Rock Outcrops/Typic Xerorthents	LOW	V. POOR
4	Typic Xerorthents/Neuns/Rock Outcrops	LOW	V. POOR
5	Deadwood/Rock Outcrops	LOW	POOR
6	Deadwood/Neuns	LOW	CONDITIONAL
7	Deadwood/Marpa	LOW	CONDITIONAL
8	Neuns	LOW	CONDITIONAL
9	Neuns/Deadwood	LOW	CONDITIONAL
10	Neuns/Typic Xerorthents	LOW	CONDITIONAL
11	Neuns/Marpa	LOW	GOOD
12	Marpa	MODERATE	GOOD
13	Marpa/Neuns	LOW	CONDITIONAL
14	Marpa/Neuns/Typic Xerorthents	LOW	CONDITIONAL
15	Speaker/Marpa	MODERATE	GOOD
16	Hotaw/Marpa	MODERATE	GOOD
17	Madonna/Marpa	MODERATE	GOOD
18	Serpentine soils	LOW	-------
19	Typic Xerorthents/Neuns/Marpa	LOW	V. POOR

SURFACE EROSION POTENTIAL

There were no highly erodible soils identified within the project area (see Table 2). Generally, with the exceptions of mapping units 15, 16 and 17, a layer of colluvial gravel covers the soils in the study area. The depth of this rocky veneer ranges from 1 to 18 inches, with an average of 9 inches. This condition is typified on the east side of Bear Wallow Mountain. This veneer protects the soil from potential erosion problems by virtually armoring it against erosion; both raindrop impact and overland flow.

Moderate intensity burns, which occurred in much of the area, killed the trees, but left the canopy intact. Within a month, much of the ground was covered with a blanket of needles, which has shown to be adequate in protecting even more highly erodible soils.

Soils in mapping units 15, 16 and 17 do not have a high stone content, and generally lack a veneer of colluvial gravel. Due to these conditions, they may be considered moderately erodible, and therefore, could be a major source of sediment. The soils in mapping units 15, 16 and 17 also have low structural strength and are subject to rutting when wet. Therefore, any roads proposed for construction in these areas should be stabilized in order to prevent both rutting and surface erosion.

Observations made during the Emergency Burn Area Rehabilitation, in March of 1988, indicated that erosion may be occurring as a result of channel downcutting in the swales of upper watersheds, where vegetative cover had been burned-off and water concentrated. The most likely area for this to occur is on the deeper, non-stony soils. Although the soils may have a low to moderate erosion hazard rating, channels within these soils can undergo significant headwall cutting and gullying. The primary area of concern is in parts of Sections 2, 3 and 35 in the Grouse Prairie area. These units have soils with relatively little colluvial gravel, unlike most other areas which are sufficiently rocky and armored to reduce this problem.

REGENERATION POTENTIAL

Most of the soils within the project area are shallow and/or very gravelly and when associated with southerly or westerly exposure have very poor prospects for intensive timber management (see Table 2). In large measure, the area is non-commercial to marginally commercial. The limiting factors in reforestation are the soil's low available waterholding capacity (AWC), the plantibility, and the brush/grass competition. A four year study, carried out on the Hayfork District, assessed the effect of AWC on seedling survival for both Douglas-fir and ponderosa pine. The study showed that both species can survive in soils that have a low AWC if competition is eliminated or controlled. Survival rate was poor when vegetation was allowed to compete. Plantibility is influenced by the amount and the size of rock fragments. Generally speaking, the more rock fragments there are, and the larger the size of those rock fragments, the more difficult it becomes to properly plant a seedling. However, even with areas perceived to have uniformly very rocky and/or shallow soils, there are local pockets that are suitable planting sites. These soils are capable of producing only a limited number of mature trees. With the exception of the Typic Xerothents, there is sufficient moisture in these soils to support a seedling throughout summer drought, but only if the competition is controlled. Selecting the best suited tree species for the site and controlling the competition will be necessary measures to insure regeneration. Trees planted on steep slopes with colluvial gravel have an additional hazard of being buried, unless special protective measures are taken.

Each soil mapping unit was evaluated for its overall regeneration potential. There are 4 categories: Very Poor, Poor, Conditional and Good. A Very Poor rating means that the unit is non-commercial, planting will be very difficult and suitable planting spots very few. A Poor rating means that the site may be commercial, but difficult to plant and will require searching for a suitable planting spot. A Conditional rating means that planting will generally be difficult due to the rock content of the soil or colluvial rock on the surface of the soil. Good has no limitation in planting. In all categories, competition will be competing for growing space, as well as for moisture and will need to be controlled.

HYDROLOGY

CLIMATE

Precipitation in the project area varies from 50 inches per year in the north near Limedyke Mountain, to 60 inches per year to the south near Forest Glen. Most of this precipitation falls between October and April. Although snowfall occurs in elevations above 4000 feet during most years, there is generally no extensive winter-long snow pack. Storms are most often produced from low pressure fronts originating from the northern Pacific Ocean, and are usually of low intensity and long duration.

Nearly all of the project area lies between 2000 and 5000 feet, which is the transient snow zone for the area. Within this zone colder storms producing snow can be followed by warmer storms which produce rainfall and melt the transient snow pack. The resulting rain-on-snow event can have a significant effect on the peak discharges of streams within the zone. Some of the largest stream runoff events in the recent history of the South Fork Trinity River watershed have resulted from rain-on-snow weather events.

BENEFICIAL WATER USES

The primary beneficial use of the water resource within the area is for anadromous and resident fish habitat. Stream channels that do not have fish habitat contribute water of quality and quantity that influences the nature of the habitat downstream. All streams within the area provide instream and riparian habitat for aquatic and water-loving plants and animals.

Only one appropriative water right exists within the project area. Its uses are domestic, irrigation, stockwatering, recreation and power. Other uses, for domestic, irrigation, etc., occur within the area under the use of riparian water rights. Direct human use of the water produced from the project area is limited to the local population that live on the parcels of private land along the South Fork Trinity River. Although some of the steep west-facing watersheds are relatively large in area they do not produce an abundance of year-long streamflow. Where access to larger streams is limited, the availability of an adequate supply of domestic water during dry years is marginal.

WATERSHED DESCRIPTION

Seventeen watersheds have been identified within the project area which were affected by the fires. They all are located on the eastern side of the South Fork Trinity watershed, extending from north of Limedyke Mountain, to just north of Forest Glen. These watersheds vary both in size and character. The largest watershed is Plummer Creek, which is comprised of 16,650 acres. Prominent subwatersheds within the Plummer watershed are Naufus Creek, Jims Creek and Bear Wallow Creek.

Except for Jims Creek, all of these subwatersheds are characterized by low gradient, alluvial channels in the upper watershed, with the lower half of each watersheds having steep gradient, bedrock controlled channels. Little Bear Wallow Creek, which is 3,980 acres, lies directly south of the Plummer watershed and is similar in character.

Both Little Bear Wallow Creek and Plummer Creek watersheds contain extensive areas of previously managed ground on the upland plateau east of the project area. Management within these watersheds occurred on both privately owned land and National Forest System land.

In contrast, the project area contains many smaller watersheds ranging from 145 to 1000 acres which have headwaters on the ridge which runs along most of the eastern side of the project area. These watersheds plunge steeply through bedrock controlled channels into the South Fork Trinity River. Most of these watersheds are unnamed and previously unmanaged.

Table 3 summarizes the watersheds within the project area.

TABLE 3
WATERSHEDS WITHIN THE PROJECT AREA

WATERSHED #	ACRES	NAME	LOCATION
1	535	UNNAMED	EAST OF RIVER MILE 38
2	395	UNNAMED	EAST OF RIVER MILE 38.5
3	145	UNNAMED	EAST OF RIVER MILE 40
4	460	UNNAMED	EAST OF RIVER MILE 41
5	620	UNNAMED	EAST OF RIVER MILE 42
6	815	UNNAMED	EAST OF RIVER MILE 43
7	270	UNNAMED	EAST OF RIVER MILE 43.25
8	16,650	PLUMMER CREEK	
8.1	2,720	BEAR WALLOW CREEK	
8.11	250	FORK OF BEAR WALLOW CK	SECTION 21
8.2	4,640	NAUFUS CREEK	
8.3	3,840	MAIN FORK PLUMMER CREEK	
8.4	2,405	JIM'S CREEK	
8.5	1,270	LOWER PLUMMER CREEK	
8.51	285	UNNAMED TRIBUTARY TO PLUMMER CK	
9	240	UNNAMED	EAST OF RIVER MILE 45
10	330	UNNAMED	EAST OF RIVER MILE 46.5
11	270	UNNAMED	EAST OF RIVER MILE 47.5
12	3,980	LITTLE BEAR WALLOW CREEK	EAST OF RIVER MILE 48.5
12.1	610	FORK OF LITTLE BEAR WALLOW CK	SECTION 27 CHRIS GAP
12.2	330	FORK OF LITTLE BEAR WALLOW CK	SECTION 34 GROUSE PRAIRIE
12.3	485	FORK OF LITTLE BEAR WALLOW CK	SECTION 35 COPPER HILL
12.4	2,555	LOWER LITTLE BEAR WALLOW CK	EAST OF RIVER MILE 48.5
13	185	UNNAMED	EAST OF RIVER MILE 50.5
14	420	UNNAMED	EAST OF RIVER MILE 51
15	920	KINGFISHER CREEK	EAST OF RIVER MILE 56
16	1210	CAVE CREEK	EAST OF RIVER MILE 56.25
17	270	UNNAMED	EAST OF RIVER MILE 52

STREAM CHANNEL PROCESSES

The following is a discussion of stream channel processes that is important to the understanding of the water resource environment and how it will be affected by the actions of project proposals. A general discussion of channel processes is followed by a specific description of the channel processes of the streams within the project area. The present conditions of the stream channels, as affected by the fire are also discussed.

General Discussion of Stream Channel Processes

Streams under natural conditions have channels that are in dynamic equilibrium; they are constantly changing, but at a natural rate through natural processes. Dynamic equilibrium is not, however, a steady state change from year to year. Changes occur due to natural fluctuations in climate and sediment delivery to the channel system. Many years of little change may be altered by a sudden change in conditions, with a long term of slow adjustment to follow.

There are eight inter-related stream channel variables: width, depth, gradient, velocity, roughness of bed and banks, discharge, concentration of sediment, and size of sediment debris. Changes in any one or a combination of these will produce a change in channel degradation (downcutting) and/or aggradation (accumulation). After the initial effect of the change a new equilibrium is established based on the new conditions.

Changes in the stream channel variables can come about naturally, such as with the occurrence of a large, intense storm, or a widespread wildfire. Changes can also be brought about by the direct or indirect actions of human activity within a watershed.

Stream channels typically perform three identifiably different functions from near the top of a their watershed to their mouth. In their highest elevations stream channels usually are downcutting as they naturally erode the landscape. Channel gradients and side slopes are generally steep and the eroded material is transported downstream through the channel.

The middle section of the "typical" stream is a zone of temporary storage and subsequent transport of sediment brought down from upstream. The gradient of this middle section is flat enough to allow for temporary sediment aggradation behind natural log debris dams or bedrock controls. During high flood flows this material is transported out of the middle section and is usually replaced with additional material from upstream.

Near the mouth of the hypothetically typical stream channel is the zone of long term aggradation and sediment storage. Here the channel gradient is very flat and there is usually a wide floodplain. Sediment moves out of this section only during large flood events. Over geologic time the uplifting of the surrounding land can leave these floodplains high above the stream channel in the recognizable form of terraces.

The natural progression of erosion and sediment transport in typical forest watersheds involves the downcutting action of small streams in the headwaters of the stream channel system.

Sediment introduced into the channel system is then transported downstream to a lower gradient section of stream where some is temporarily stored. Sediment moving out of the transition zone moves into the lower reaches of long-term storage on floodplains or is transported out of the watershed on its way to the ocean. This movement of sediment is in a state of equilibrium unless a natural or man-made fluctuation occurs significant enough to realign the system into a new equilibrium.

Natural Channel Processes of Streams Specific To The Project Area

The natural character of the streams in the project area is largely a result of their channel gradient. Channel gradient is expressed as a percentage of the vertical drop of a channel divided by the horizontal distance of the stream segment being considered. Over long distances the gradient is controlled by the steepness of the land with the actual channel bottom being controlled by bedrock. In any short segment of stream channel the gradient is often controlled by material introduced into the channel. In forested watersheds logs and smaller woody debris often form natural small dams which serve as intermediate stream channel gradient controls. On typical stream channels the section of temporary sediment storage and transport is most influenced and characterized by the presence of these small gradient controls.

As previously discussed there are two types of watersheds in the area; ones that drain the edge of the upland plateau before breaking off into the steep slopes of the eastern South Fork Trinity River canyon, and the others that originate at the edge of the uplands.

Little Bear Wallow Creek

Little Bear Wallow Creek is typical of the streams originating on the upland plateau. It has a low channel gradient where it originates in Little Bear Wallow Meadow. Near the 4000 foot elevation, the channel plunges off of the plateau and flows down a steep channel gradient for about a half mile. The stream gradient then flattens out and stays somewhat constant until its confluence with the South Fork Trinity River.

The natural process of erosion and sedimentation in Little Bear Wallow Creek is somewhat different than what was previously discussed for a typical forest stream channel. The headwater of the Little Bear Wallow Creek watershed, being on the upland plateau, is relatively stable, nearly flat land, and not a zone of channel downcutting. The steeper slopes where the stream runs off of the plateau serves as the principal natural source of sediment for this stream system. The flatter gradient section of the lower portion of Little Bear Wallow Creek acts as a zone of temporary sediment storage and of sediment transport during flood flows. There is no portion of the channel that has a gradient flat enough to provide for long-term sediment storage. Within the project area only Plummer Creek, near its mouth, and the South Fork Trinity River have long-term sediment storage floodplains.

Watershed #4

The stream channel of Watershed #4, originating at Limedyke Mountain, is typical of the watersheds draining the west facing slopes of the South Fork Trinity River canyon. Its gradient is not at all like a typical forest stream channel gradient in that the stream plunges at a steady rate from the top to the bottom of the watershed. The stream gradient plummets at an average rate of 31%, extremely steep for any stream. There are several waterfalls and cascades down this bedrock controlled channel. The entire channel length serves as a fast conduit for sediment entering the channel from the extremely steep side slopes. There are no portions of this stream, or others similar to it, that serve as temporary or long-term storage sites for sediment.

Cave Creek

Although Cave Creek is similar to Little Bear Wallow Creek in that it originates on the upland plateau, its channel gradient characteristics are unique. The upper mile and a quarter of the channel has an average gradient of 9.3%, however, the side slopes draining into the main channel are steeper. The result is that the side slopes provide the source of sediment and the upper channel acts as a zone of temporary storage and sediment transport. As the main channel descends through the middle of the watershed, its average gradient increases to 16.6% and then to 27.9%. These gradients are too steep to provide many opportunities for temporary storage of sediment and the channel serves primarily as a sediment conduit. Although the last quarter mile of Cave Creek returns to a gradient of 8.3% only a small amount of temporary sediment storage is achieved before delivery to the South Fork Trinity River.

Kingfisher Creek

The gradient of Kingfisher Creek is similar to the channel gradient of Watershed #4 in that they both start from the edge of the upland plateau, but near the middle of the Kingfisher Creek watershed the gradient flattens out somewhat. Nearly a mile of stream channel has an average gradient of 13% in Kingfisher Creek. This section provides temporary sediment storage opportunities behind log debris dams and bedrock controls. The steep side slopes of this watershed provide a considerable amount of naturally eroding sediment material for the main channel to deliver to the South Fork Trinity River. The lower portion of the channel regains a steep profile with no further low gradient reaches.

Stream Channel Conditions Following The Wildfire

For the most part the fires of 1987 did not affect the watersheds of the project area as severely as other watersheds within the Hayfork District. Although the fire burned a large portion of the project area, intense fire damage occurred primarily on or near major ridgetops and on many of the spur ridges. Most riparian areas near the drainages were not burned hot enough to kill the overstory conifers. The exceptions are the upper watersheds of Cave Creek and Kingfisher Creek.

Although the main channels of these streams were spared from complete conifer mortality, smaller tributary areas, especially in Cave Creek, were completely killed.

In general, fires can have major effects on surface and subsurface hydrology, and therefore, baseflows and increased storm peakflows. Groundwater levels increase due to tree mortality and decreased evapotranspiration. Therefore, summer flows can be greater following fires. Due to soil changes and loss of the litter layer, infiltration can be reduced and overland flow increased, thus contributing to greater peak streamflows. Depending on burn intensity and resulting site conditions, peak streamflow increases can be great. In addition, the potential for affecting significant changes in snow hydrology is quite possible due to the size of the openings, and their influence on accumulation and melt rates, especially in the transient snow zone. More discharge in streams means more power to downcut channels, and to move larger amounts of sediment. The result is a disruption of the dynamic equilibrium of the channel for a period of time until a new equilibrium can be achieved.

Burned over watersheds usually result in an increase in surface erosion and downcutting of otherwise stable channels. This means an increase in the concentration of sediment being moved through the system. Another consequence of the fire is the burning out of log and smaller woody debris dams. This results in less storage capacity in the channels and more sediment available for transport. All of these interrelated factors result in the further disruption of the stream's equilibrium for a period of time.

Where the local channel gradient has been controlled by woody debris dams the effect of a fire is to remove the gradient controls and thus reduce the stream's temporary sediment storage capacity. With local gradient controls removed the potential for further destabilization of the stream channel increases.

The period of time required for a stream channel to reach a new stabilized state of dynamic equilibrium after the occurrence of a wildfire depends on the extent and intensity of the fire, and on the sensitivity of the stream channel to changes in stream discharge, concentration of sediment, and channel gradient. The effects of the fire on each of the specific watersheds previously discussed varies with all of the above factors.

Little Bear Wallow Creek

The fire burned severely in the Little Bear Wallow Creek drainage primarily on the steep ridges adjacent to the tributaries of the main stream channel. Stream channel discharge was not significantly affected because of the relatively low percentage of the entire contributing watershed that was burned hot enough to kill the overstory. Some increase in sediment concentration could have occurred during the relatively low rainfall winter of 87-88, but little evidence of erosion or sediment transport exists. The fire did little to disrupt the zone of temporary sediment storage and transport as the intensity was light near the stream in that section. Overall the fire has had little effect on the dynamic equilibrium of the main channel of Little Bear Wallow Creek.

Watershed #4

The extremely steep watersheds such as #4 along the west facing South Fork Trinity River canyon are almost "armor plated" against effects of a wildfire. Their channels are so steep as to be nearly immune to any increases in discharge or sediment concentration, and they don't have any temporary sediment storage sites to be affected. Since watershed #4 and others like it were only lightly to moderately burned there has been no effect on their dynamic equilibrium.

Cave Creek

Most of the Cave Creek watershed burned, with large stands of trees being totally killed on the main ridges, lower spur ridges and side slopes. Moderate and low intensity fire killed trees scattered throughout most of the remainder of the watershed. Within the severely burned areas near the top of the watershed several of the ephemeral and intermittent channels showed evidence of increased sediment concentrations, i.e. the straw bale check dams installed as part of the emergency burn rehabilitation effort were filled with sediment. There was also visible evidence of increased discharge in ephemeral channels that had not previously shown evidence of channel downcutting.

Fortunately the riparian area near the main channel was not severely burned. The portion of the main channel from the middle of Section 1 down to the area known as Devils Kitchen has an average gradient of 9.3% and is a zone of temporary sediment storage and transport. An examination of the channel revealed that the fire had not burned out the existing log and woody debris control structures. There are a few trees that have been killed by the fire and have fallen into the stream. There will be more fire killed trees that will fall into the channel in the next few years. The result should be a net increase in the amount of woody debris providing temporary gradient controls to this portion of Cave Creek.

From Devils Kitchen down to a quarter mile upstream from the confluence with the South Fork the channel gradient is much steeper with occasional waterfalls. Winter flood flows keep this section relatively free of woody debris. Although the fire did creep through some parts of the riparian area there is little evidence of any direct effects on this portion of the stream channel.

The last quarter mile of Cave Creek has a lower gradient and a wider riparian zone. Large woody debris once again is an important component of the natural equilibrium of the channel. There is no evidence that the fire had any influence on this portion of Cave Creek.

Kingfisher Creek

Kingfisher Creek is similar to Cave Creek in that fires of various intensities burned throughout the watershed. Highest intensities occurred on the ridgetops and on portions of the steep side slopes. Only light intensity fire burned through the area immediately adjacent to the main channel of Kingfisher Creek.

Along the middle section of this stream the channel flows through a very steep-sided inner gorge. The stream gradient is low enough to provide for temporary sediment storage sites. The steep side slopes have been, for the most part, only lightly burned. But because they are so steep there has been an apparent increase in dry ravel of gravel size surface material, and in a few places, small debris avalanches. Along with this added sediment there has also been an increase in the amount of large woody debris as several large burned-out snags have rolled down into the narrow channel bottom. Several new woody debris dams have formed since the fires and not all of them have been filled to capacity with the newly arrived sediment. This appears to be evidence that natural processes of fire effects and recovery are taking place in this watershed with the end result being the establishment of a new dynamic equilibrium sooner than might be expected.

BURNED AREA EMERGENCY REHABILITATION

In response to the potential for significant watershed and fisheries degradation due to the fires, watershed protection measures were prescribed and implemented by interdisciplinary teams shortly after the fires were controlled. Two rehabilitation programs were implemented: Burned Area Emergency Rehabilitation (EBAR), and suppression damage rehabilitation. Suppression damage rehabilitation was meant basically to prevent water quality degradation related to disturbances caused by fire suppression activities, which included constructed firelines. Waterbarring, mulching, seeding, cleaning debris out of stream channels and constructing vehicle barriers were measures commonly employed.

The objective of Burned Area Emergency Rehabilitation is to preserve site productivity through the prevention of surface erosion, maintain beneficial uses of water through the control of water quality, and to prevent threats to life and property. Measures prescribed for all the burned areas generally were concentrated in areas which burned hot, in highly erodible areas, in stream channels which either burned out or are downstream from badly burned areas, or in watersheds where the water is domestically utilized. The measures employed were aerial seeding of annual grasses, construction of straw bale check dams in ephemeral and intermittent stream channels, construction of rock and log check dams in some intermittent and perennial channels, contour falling of small trees, straw mulching, hydroseeding, rocking of roads within highly erodible areas, and stream channel cleanout. Barring catastrophic climatic events, these measures should help lessen degradation of water quality and fisheries habitat.

Due to the roadless nature of the project area and the widespread dispersal of the high intensity burn areas there was relatively little EBAR work done within the project area. Fire suppression work was done on the constructed firelines, mostly in the form of waterbarring. A total of 25 straw bale check dams were constructed within the watersheds affected by the project. They were primarily located in the Cave Creek watershed in the most intensely burned portion that is outside of the roadless area. Four hundred acres of aerial seeding of annual grasses were performed in the area of high intensity burning around Grouse Prairie, and in areas adjacent to Cave and Kingfisher Creeks.

Many of the straw bale check dams were filled with sediment by February of this year so additional dams were constructed in March. Aerially seeded grasses did not grow well in the cool fall and winter of 1987-88 and were not effective as a soil erosion deterrent during the first rainy season. Addition rehabilitation needs are discussed in the Watershed Recovery portion of this document.

CUMULATIVE WATERSHED EFFECTS

The South Fork Trinity River has been adversely affected by both natural and man-caused events. A recent study documents the history of impacts, watershed condition, cumulative watershed effects and fisheries habitat present within each subwatershed in the South Fork Trinity watershed (Haskins and Irizarry, 1988). Significant resource impacts historically date back to the 1850's when gold was discovered within stream and terrace deposits along the Trinity River and its major tributaries, including the South Fork Trinity. Signifiant placer mining took place within the Hayfork Creek watershed which resulted in widespread channel degradation through pool infilling, channel broadening and destruction of important riparian vegetation. Although placer mining has slowed and is regulated, significant channel and habitat effects linger. As settlers inhabited Hayfork and Hyampom valleys, flood irrigation was employed with water drafted out of the South Fork Trinity and Hayfork Creek. Continuing today, the practice has lead to reduced flows, especially within Hayfork Valley, which has contributed to high stream temperatures and limited rearing habitat for juvenile fish.

Logging has had a great impact on the South Fork Trinity watershed. Logging was relatively limited in the basin until the 1950's. During the severe storm of 1964, tremendous flooding occurred as a result of a major warm winter storm melting a large snow pack which resided in the transient snow zone. Some tributary watersheds on South Fork Mountain, containing large private inholdings, had been intensively logged since the late 1950's. Many of these watersheds were catastrophically gutted by debris torrents which were triggered by streamside landslides during the event. Millions of cubic yards of material from these watersheds were transported and deposited into the South Fork in a brief period of time. This tremendous pulse of sediment filled pools, destroyed riparian vegetation and triggered debris slides within the inner gorge of the South Fork Trinity River.

The previously described upland area within the central portion of the South Fork Trinity watershed, due to its relatively gentle slopes, was the site of some intensive selection logging. This logging initially occurred in the late 1950's under the concept of "unit area control". Management practices were poor, including skid trails and landings located in drainage areas, and high levels of roading. Clearcut logging commenced in the early 1970's. During the 1964 flood, many subwatersheds within the area experienced, and contributed to downstream cumulative watershed effects. These effects included channel aggradation, widening, bank undercutting and general channel instability.

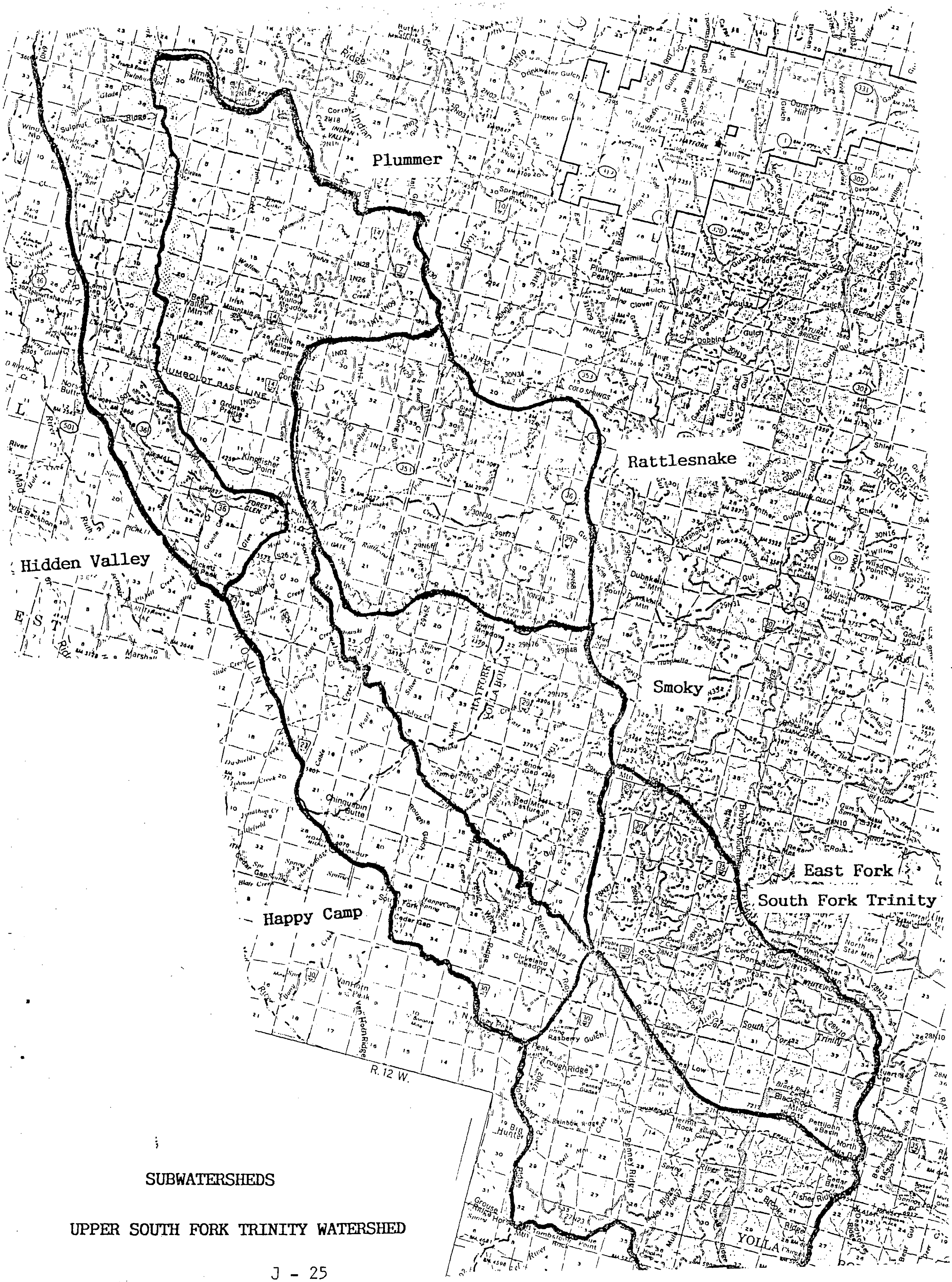
Although it is apparent that the effects of the 1964 flood on the west side of the watershed far outweigh the impacts in the eastern upland area, the net effect was significant. Prior to the flood of 1964, the main stem South Fork was characterized by scattered large, deep pools interspersed with shallow pools, riffles and rapids. Gravel and fine sediment deposited during and after the 1964 flood infilled most of the large pools and broadened the riffle sections through aggradation. Today, the middle and lower South Fork is characterized by a predominently wide flood plain, shallow riffles and shallow pools occasionally interspersed with deeper pools. Debris slides line many parts of the river. Additionally, millions of cubic yards of sediment still remain in the lower South Fork and its tributaries in the form of terraces or channel fill. This material is seasonally mobilized through scour and lateral erosion. Although the watershed is being flushed of this material, a significant volume is still located in the basin.

The main channel of the South Fork has been severely impacted at the lower portion of this watershed due both to the direct influence of these degraded subwatersheds and to a major change in channel gradient. The South Fork descends over 800 feet within the project area, between river mile 56 at Forest Glen to river mile 38 near Sulphur Glade Creek. In comparison, the river bed falls only an additional 900 feet between river mile 38 and Salyer, at the mouth of the South Fork. The distinct change in gradient at the lower end of the project area may have an influence on sediment deposition. The first continuous stretch of channel aggradation is found at the mouth of Sulphur Glade Creek, and essentially continues downstream to Salyer. This appears to be the upstream edge of the sediment wedge related to the 1964 event, which is moving out of the basin. Several large debris slides are evident adjacent to the South Fork, which were triggered by the 1964 event.

CUMULATIVE EFFECTS, UPPER SOUTH FORK TRINITY RIVER

The entire South Fork Trinity Watershed is 620,000 acres in size, of which 510,000 acres lie within the boundaries of the Shasta-Trinity National Forests and 425,000 acres are National Forest System lands. The South Fork Trinity watershed can be divided into three geographic area; Upper South Fork Trinity which extends upstream from Hyampom to the headwaters, Hayfork Creek extending from the confluence of Hayfork Creek with the South Fork in Hyampom Valley, and the Lower South Fork Trinity extending downstream from Hyampom Valley. The study performed by Haskins and Irizarry (1988) evaluated these individual subwatersheds within these broader watersheds, and finally the entire South Fork. The following information comes from that study.

The Upper South Fork Trinity watershed, including the project area, contains 186,000 acres. For analysis purposes, it has been subdivided into six watersheds or sets of subwatersheds (See Subwatershed Map below). These range in size from 22,000 to 33,000 acres and include the Upper South Fork Trinity, East Fork South Fork Trinity, Happy Camp, Smoky, Rattlesnake, Hidden Valley and Plummer. An analysis of the potential for cumulative watershed effects have been performed for these watersheds following the Shasta-Trinity cumulative effects analysis methodology, documented by Haskins (1986).



SUBWATERSHEDS

UPPER SOUTH FORK TRINITY WATERSHED

Table 5 summarizes the results of the analysis.

TABLE 5

CUMULATIVE WATERSHED EFFECTS SUMMARY

UPPER SOUTH FORK TRINITY RIVER WATERSHED

WATERSHED	ACRES	THRESHOLD OF CONCERN	PROJECTED EQUIVALENT ROAD AREA
UPPER SOUTH FORK	26,741	14%	10.6%
EAST FORK SOUTH FORK	23,864	14%	11.2%
HAPPY CAMP	23,120	12%	9.0%
SMOKY	21,834	16%	9.5%
RATTLESNAKE	30,974	16%	17.0%
HIDDEN VALLEY	33,188	12%	10.2%
PLUMMER	26,840	16%	7.8%
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	186,561	AVG 14.3%	AVG 10.8%

The Upper South Fork Trinity subwatershed is located in the southern portion of the larger Upper South Fork Trinity watershed. It is 26,741 acres in size, with only approximately 500 acres of privately owned land within it. Nearly 5,500 acres of the Yolla Bolla-Middle Eel Wilderness lie within the watershed's headwaters. Primary tributaries include Mule Gulch, Shell Mountain Creek, and Raspberry Gulch. ERA levels are at 10.6%, primarily due to past or planned timber harvesting within Raspberry Gulch and on Buck and Bierce Ridges. This watershed is relatively stable, with some inner gorge mass wasting at its lower end. Much of the channel is bedrock controlled, and little channel degradation has occurred, except for within Raspberry Gulch.

The East Fork of the South Fork Trinity watershed lies directly north of the Upper South Fork subwatershed, and also headwaters in the Yolla Bolla-Middle Eel Wilderness. It is 23,864 acres in size, having approximately 1,300 acres of wilderness and 600 acres of private land within it. Primary tributaries include Dark Canyon, Texas Chow and Prospect Creek. ERA levels are at 11.2% due to intensive harvest activities in the past, and projected activities within the watershed. Significant channel degradation has occurred within the Prospect Creek watershed, although, channel condition is presently improving due to natural stabilization in conjunction with watershed restoration efforts. The lowermost portion of this watershed is in relatively poor condition due to widespread landsliding along the main channel. In general, channel condition is considered good to poor.

The Happy Camp watershed is located on the southern end of South Fork Mountain, and extends from Bierce Creek to Forest Glen. It is 23,120 acres in size, and contains approximately 2,500 acres of private land.

It is comprised of approximately 10 watersheds, including Bierce, Happy Camp, Rough Gulch, Frisbee, Farley, Marie, Cable, Charlton, Collins and Mud Creeks. All these watersheds are considered to be highly sensitive to cumulative watershed effects, and therefore, the threshold of concern (TOC) is 12% ERA. The ERA value for this watershed is 9.0% ERA which includes both past activities and projected activities on private and National Forest System Lands. Some of the tributary watersheds are considered to be in poor condition due primarily to landsliding, including Bierce, Charlton, Marie and Farley Creeks. The South Fork Trinity River channel within this watershed is generally in good condition except where isolated aggradation has taken place within the flatter gradients along St. Jacques Place and Stockton Flat.

The Smoky watershed lies opposite the Happy Camp Watershed on the eastern side of the South Fork Trinity. It is 21,834 acres in size, with approximately 500 acres of private holdings within it. This watershed contains Red Mountain Creek, Smoky Creek and Silver Creek watersheds. In general, the headwaters of these creeks, which lie in the upland area, have been impacted in the past, and are in moderate to poor condition. Watershed restoration activities are presently underway within this portion of the watershed. The lower, steeper areas are considered to be in good channel condition. The TOC for the watershed is 16% ERA and the projected ERA value is 9.5%, which includes activities planned in the future.

The Rattlesnake Creek watershed is 30,974 acres in size, and lies east of Forest Glen. Major tributaries include: Post Creek, Glade Creek, North Fork Rattlesnake Creek, and Flume Gulch. Approximately 3,000 acres of the watershed is privately owned. This watershed dissects the heart of the eastern upland area, and because of past management activities, has been identified as having undergone cumulative watershed effects in the past. Due to restoration activities and natural recovery however, channel condition has improved. Unfortunately, this watershed was severely impacted by the southern edge of the Flume fire and much of the Flume and western portion of the North Fork Rattlesnake watersheds were intensively burned. Because of these impacts and the ERA levels projected from the salvage projects proposed within these watersheds, the ERA level is 17%, slightly above the 16% TOC. The potential for additional cumulative effects and impacts to Rattlesnake Creek is possible, depending on storm intensity and the success of the extensive Emergency Burn Rehabilitation and recovery work which has been performed to date. Special management practices are being implemented during salvage harvesting within this watershed to minimize potential effects, and allow for more rapid watershed recovery.

The Hidden Valley watershed lies on South Fork Mountain opposite the project area. Like the Happy Camp watershed, it too contains a number of subwatersheds which all are direct tributaries to the South Fork Trinity River. These include: Glen, Granite, Swift, Sulphur Glade, Hitchcock, Cold Springs, Johnson, Jessie and a number of other unnamed creeks. The watershed is 33,188 acres in size, containing approximately 5,500 acres of privately owned lands. The TOC is considered 12% ERA. This portion of South Fork Mountain contains some of the watersheds which were significantly impacted during the 1964 flood. These watersheds include: Sulphur Glade, Hitchcock, Cold Springs, Johnson and Jessie Creeks. All of these watersheds remain in poor condition, primarily due to continuing mass wasting adjacent to the severely gutted channels.

However, although still containing active areas, these watersheds have stabilized considerably since 1975. In addition to the flood related effects, the Jessie fire burned several thousand acres within the lower portion of the watershed between Jessie and Cold Springs Creek. The ERA value for this watershed is 10.2% which considers past activities, fire effects from the Jessie fire, proposed salvage logging of the Jessie fire and projected harvest activities in the basin.

In summary, Table 4 is a relatively simplistic representation of existing ERA levels in relationship to threshold of concern values, both for the individual watersheds, and the entire upper South Fork Trinity watershed. These values quantify the results of field investigations within the last decade.

Watershed condition is quite varied within the South Fork Trinity above and adjacent to the project area. The 1964 flood event had a marked influence on channel condition, stability and fisheries habitat. Cumulative watershed effects have occurred within both the East Fork South Fork and Rattlesnake watersheds, however, due to restoration activities and natural recovery over the last 24 years, improvement is occurring. Within other watersheds, local problem areas exist, however, conditions continue to improve.

Over the last seven years, cumulative watershed effects have been a significant management issue and each project proposed within the watershed has been evaluated for the potential for contributing to watershed degradation. Projects have been designed to minimize water quality impacts through delineating sensitive areas within the watersheds, such as intermittent and perennial streams, valley inner gorges and unstable sideslopes, and managing them through means believed to be consistent with their sensitivity. Because of all these actions, the watershed is continuing to recover from the 1964 flood event. No past or present actions within the upper watershed are predicted to contribute to significant cumulative watershed effects within, adjacent to or downstream from the project area.

CUMULATIVE WATERSHED EFFECTS WITHIN THE PROJECT AREA

The project area lies within the Plummer watershed. This watershed is 28,640 acres in size, containing approximately 1,800 acres of privately owned lands. As previously described, seventeen watersheds lie within the project area, with some of the larger watersheds divided into subwatersheds for ease of analysis (Table 3). The following discussion focuses on the project area watersheds.

There are two areas of consideration of cumulative watershed effects within the project area: (1) the effect of past management activities and (2) the effect of the burn on watershed condition both present and in the future. Each will be evaluated in terms of: (1) the effect of the fire and past management activities on slope and channel processes due to compaction, reduced infiltration, loss of surface cover, channel destabilization and overall site disturbances, and (2) the effect of large openings within the transient snow zone on snow accumulation and melting rates, and resulting erosion and peak streamflows related to harvest units and intensively burned areas. Although these are both cumulative watershed effects, the potential for each are evaluated separately.

To understand each of these issues, it is important to understand the integrated effects of both fire and harvesting on watershed processes.

BURN EFFECTS

There are many direct effects from the fires and it is predicted that there can also be significant cumulative effects. The critical factors are: the intensity of the burn, the location of the burn relative to sensitive land types, extent of the burn within the watersheds, and past condition of the watershed. Past watershed conditions are: channel condition, mass wasting, surface erosion, and level of management activities. Sensitive land types include: highly unstable areas, highly erodible soil types, hydrophobic soils, and certain stream channels (Haskins and Zustak, 1988).

As Swanson (1981) discusses, in order to evaluate fire effects on geomorphic processes, it is necessary to understand the roles of vegetation in regulating soil-sediment routing through watersheds. Soil is moved down hillslopes by a variety of mass wasting and surface erosion processes. Once in the channel, this material, now sediment, is moved downstream by another set of transfer processes. A given particle of material moves through a watershed in a series of steps by different processes. During its transit through a watershed, material is temporarily stored in various types of storage sites, such as behind downed logs on hillslopes, or behind rocks or organic material in channels. Vegetation affects the rate of each transfer process and the capacity and turnover time of storage sites. Root networks bind soil, thereby reducing mass wasting potential from slopes and stabilizes flood-plain deposits; organic litter protects soil from surface erosion; blowdown of trees cause soil movement from their root ball, but the down log provides storage sites. Large organic material within stream channels provide sediment storage sites, however sediment is released in response to decomposition, scour or failure. These and other factors result in a complex response of soil-sediment routing systems to ecosystem disturbance from fire. When intense fire disturbs or consumes the organic storage sites, it leads to rapid responses in soil and sediment movement since the natural dynamic equilibrium has been dramatically changed. Since each geomorphic process is regulated by a different set of vegetation factors, each process will recover to predisturbance rates over different time periods, determined in part by the pace of vegetative recovery. In addition, the greater the burn intensity, the longer the time needed for complete recovery.

Burn intensity varied considerably within each of the burned areas. It is estimated that approximately 15 percent of the burn areas were of high intensity, with perhaps 35 percent moderate and 50 percent light. Many areas within the project area did not burn at all.

Areas considered to have burned hot are characterized as having total duff consumption, consumption of organic material within the soil surface, large areas of white ash, burned out roots and soil crusting beneath white ash. In these hot burn areas, tree canopies were generally either consumed or badly scorched. Downed logs are common in these areas due to snags burning at their base and falling following the fires. Needle cast is very heavy in the scorched areas.

Moderately burned areas are characterized as having only limited areas of white ash, with a partially consumed duff layer and little soil crusting. In these moderately burned areas the canopies were generally not consumed, but significant needle scorch occurred, especially on the lower tree limbs. Because of the scorch, significant needle cast occurred in some of these areas. Many down snags are evident in these areas also. Light burn areas were quite common within the fire complexes. For these areas there was spotty duff consumption, generally consuming only patches where heavy fuel concentrations existed. Soil crusting was also limited to scattered root burnouts. In the lightly burned areas, needle scorch occurred only on some of the lower limbs, and some needle cast is evident.

In watersheds where significant portions were affected by the fires, there is a potential for cumulative watershed effects. Depending on the intensity of the fire, the location relative to sensitive land types, the quality and quantity of past management practices and the pre-fire condition of the watershed, the degree of cumulative effects can range from insignificant to severe. This largely depends on the sensitivity of the watershed. Some watersheds are intrinsically more vulnerable to cumulative watershed effects due to the level and extent of sensitive land types.

CUMULATIVE WATERSHED EFFECTS ANALYSIS

Cumulative watershed effects appear to result from the combination of changes in erosion rates, sedimentation rates and peak streamflows within watersheds in response to disturbance activities including timber harvesting, roading and wildfires. This combination can lead to an acceleration in deleterious off-site impacts, including channel aggradation, degradation, bank undercutting, inner gorge mass wasting and an entire assemblage of impacts to beneficial uses. Specifically, it appears that cumulative impacts are a function of three major factors: (1) the amount of sensitive ground (areas of slope stability or surface erosion hazards) and its relative hazard level within a watershed; (2) the type, level, and chronology of land disturbing activities within a watershed which can influence changes in peak streamflows; and (3) the location of those activities relative to sensitive grounds.

In modeling cumulative watershed effects during timber sale planning, surface erosion potential, mass wasting potential, slope gradient and peak flow characteristics are the primary sensitive land determinants. These characteristics are used to define a watershed's sensitivity and therefore, its threshold of concern (TOC). Management levels are then kept, in terms of Equivalent Road Area (ERAs), below the threshold defined for the watershed. During timber sale planning, Best Management Practices are prescribed, including streamside management zone objectives for all streams potentially affected by the proposed activities. However, in the burned areas, particularly where the intensity was moderate and high, conditions exist which do not resemble the results of timber harvest operations. For instance, stream channels which typically are protected from disturbance during timber harvesting were significantly affected by the fires, and now may be the most sensitive land in the watershed.

The model we have calibrated to use for evaluating the potential for cumulative effects from timber harvest operations does not consider channel sensitivity, however, and is not entirely applicable for predicting the potential for cumulative watershed effects related to the burns.

To answer these modeling concerns, it has been recognized that there are slope effects and channel effects which require analysis. Slope effects, related to the burn, have been likened to broadcast burning and have been given an appropriate disturbance coefficient. Since stream channel burnout can have a marked influence on channel stability, and therfore sensitivity, this has led to a lowering of the watershed sensitivity, therefore lowering some watershed's threshold of concern. For some relatively insensitive channel types, such as steep bedrock controlled channels, watershed condition did not appear to be increased, and therefore, the TOC was not adjusted.

Transient Snow Zone Analysis

Table 6 documents acres and the percentage within each of the watersheds which burned moderately or intensively.

TABLE 6

BURN AREA DATA FOR PROJECT WATERSHEDS

WATERSHED #	ACRES	ACRES BURNED	%WATERSHED BURNED MODERATELY OR HOT	BURN ERA
1	535	25	5	0.1
2	395	49	12	0.6
3	145	15	10	0.5
4	460	45	10	0.5
5	620	105	17	0.9
6	815	285	35	1.7
7	270	80	30	1.5
8	16,650	476	3	0.2
8.1	2,720	200	7	0.4
8.11	250	55	22	1.1
8.2	4,640	0	0	0
8.3	3,840	0	0	0
8.4	2,405	87	4	0.2
8.5	1,270	99	8	0.4
8.51	285	115	40	2.0
9	240	36	15	0.8
10	330	26	8	0.4
11	270	29	10	0.5
12	3,980	98	3	0.1
12.1	610	275	45	2.2
12.2	330	132	40	2.0
12.3	485	120	25	1.2
12.4	2,555	0	0	0
13	185	47	25	1.3
14	420	230	55	2.8
15	920	511	55	2.8
16	1210	725	60	3.0
17	270	95	35	1.7

Table 6 indicates that nine watersheds within the project area had over 30% of their area burned at a moderate to high intensity level. These include watersheds 6, 7, 8.51, Forks of Little Bear Wallow Creek (12.1 and 12.2), 14, Kingfisher Creek (15), Cave Creek (16) and watershed 17. Of these watersheds, 8.51, Forks of Little Bear Wallow Creek (12.1, 12.2), 14, Kingfisher and Cave Creeks had the greatest burn with 40%, 45%, 40%, 55%, 55%, and 60% of each watershed burned respectively. Of these, Cave, Kingfisher, watershed 14, and the Forks of Little Bear Wallow (12.1, 12.2) burned throughout, from top to bottom, and burn intensity was rather hot. Within the other watersheds, the fires burned most intensively in their headwaters along the ridgetop, with some spot fires in the mid to lower portion of the watersheds. Due to this difference in fire distribution and intensity, the majority of the watersheds did not suffer significant effects.

However, watershed 14, Kingfisher and Cave Creeks did undergo widespread slope effects, while due to the nature of the channels, only upper Cave Creek and Kingfisher suffered extensive channel destabilization.

As has been previously described, the potential for rain-on-snow storm events within this area is considered a management concern due to the project's location within the transient snow zone. This phenomenon is one of relatively recent recognition in the context of contributing to cumulative watershed effects. Recent studies by Harr and McCorison (1979), Harr (1981), Christner and Harr (1982), Megahan (1984), Harr (1986), and Berris and Harr (1987) have generally compared snow accumulations, melt, storm runoff and peak streamflows between clearcut and uncut watersheds in the Pacific Northwest. They generally conclude that there is greater runoff during rain-on-snow events from the the clearcut areas. Megahan analysed the potential for increased groundwater and runoff within the transient snow zone between a logged and unlogged watershed in Idaho. During the experiment, a wildfire burned both his control and logged watersheds. All the leaves on the trees and understory were killed by the fire, however there were no detectible increases in maximum snow water content on the unlogged watershed compared to pre-fire years. He concluded that total timber removal influenced subsurface runoff by increased total snow accumulation, changing snow accumulation, changing snow distribution and increasing snow ablation rates. Logging caused most of the changes in snow accumulation and melt. There was some suggestion of burning effects as well, but these were minimal compared with the logging effects. However, it is expected that over a longer period of time, the response from the burned area would resemble that from the logged area.

Based on analysis of these studies and field investigation of the project area, it is not anticipated that openings caused from the fire have lead to any significant runoff event within the majority of watersheds within the project area during the winter of 1987-1988. For the six watersheds which burned intensively, it is probable that some water quality degradation will occur in the event of a significant storm event. In the next ten years, as the dead trees fall down, large natural, contiguous openings will occur, especially within watersheds 8.51, 12.1, 12.2, 14, 15 and 16. These large openings will have an effect on snow hydrology and could potentially contribute to increased stream runoff and the potential for cumulative watershed effects. It is conceivable that the potential for these types of effects will decrease over time as the openings revegetate and resprout. Artificial regeneration should be considered as a means to accelerate the vegetative recovery, and therefore lessen the potential for cumulative watershed effects. It is considered unlikely that any of the other watersheds within the project area will be adversely affected through cumulative watershed effects due to the the distribution pattern of the burns and the smaller areas impacted.

Equivalent Road Area Analysis

Table 7 summarizes the ERA data including past management activities and fires, and the TOC for each of the study watersheds. Some of the watershed TOC values were adjusted downward due to severe burn effects to the channels.

TABLE 7

CUMULATIVE WATERSHED EFFECTS SUMMARY

EXISTING SITUATION

INCLUDES ALL FORESEEABLE ACTIVITIES, NFS AND PRIVATE LANDS

WATERSHED NUMBER	ACRES	NAME	ROAD ERA%	HARVEST ERA%	BURN ERA%	TOTAL ERA%	TOC
1	535	UNNAMED			0.1	0.1	16%
2	395	UNNAMED			0.6	0.6	16%
3	145	UNNAMED			1.1	1.1	16%
4	460	UNNAMED			1.2	1.2	16%
5	620	UNNAMED			0.9	0.9	16%
6	815	UNNAMED			0.6	0.6	16%
7	270	UNNAMED			0.9	0.9	16%
8	16,650	PLUMMER CREEK	1.3	4.6	<0.1	6.1	16%
8	2,720	BEAR WALLOW CREEK	0.5	1.7	0.4	2.6	16%
8	250	FORK OF BEAR WALLOW CK			1.1	1.1	16%
8.2	4,640	NAUFUS CREEK	2.2	2.3	0	4.5	16%
8.3	3,840	MAIN FORK PLUMMER CK	1.8	5.0	0	6.8	16%
8.4	2,405	JIMS CREEK	1.4	2.7	0.2	4.3	16%
8.5	1,270	LOWER PLUMMER CREEK			0.4	0.4	16%
8.51	285	UNNAMED PLUMMER TRIB	1.0		0.1	0.1	16%
9	240	UNNAMED			2.0	2.0	16%
10	330	UNNAMED			0.4	0.4	16%
11	270	UNNAMED			0.6	0.6	16%
12	3,980	LITTLE BEAR WALLOW CK	4.1		0.1	4.2	16%
12.1	610	FORK OF L B W CR.			1.1	1.1	16%
12.2	330	FORK OF L B W CR.			2.3	2.3	14%
12.3	485	FORK OF L B W CR.	5.0		0.5	5.5	16%
12.4	2,555	FORK OF L B W CR.	1.2	3.5	0	4.7	16%
13	185	UNNAMED			1.3	1.3	16%
14	420	UNNAMED			1.0	1.0	16%
15	920	KINGFISHER CREEK	0.2	0.3	2.8	3.3	14%
16	1210	CAVE CREEK	1.5	9.2	1.6	12.3	14%
17	270	UNNAMED			0.5	0.5	16%

It is apparent that the vast majority of the watersheds were in an unmanaged state prior to the fire, and that their respective ERA levels were relatively low. As has been previously discussed, only three watersheds had a significant area burn intensively. Furthermore, these watersheds are not considered highly sensitive to undergoing cumulative watershed effects due to the relatively stable nature of their channels and the non-erodible soils which have developed within them. Although mass wasting features are apparent within each of the watersheds, they are not considered to be extremely unstable.

Cave Creek has the highest ERA value, however, this includes ERA values from the proposed Flume salvage project presently being planned within it. It also has the lowest TOC due to the channel degradation caused by the fire. The analysis indicates that only Cave Creek has a risk of undergoing cumulative watershed effects due to the combined effects of the wildfire, past management activities, and management activities planned for the near future. These measures include road rocking, scarification of skid trails, minimizing site preparation to retain surface cover on harvest units, and consideration of wider SMZs to minimize potential effects to the stream channels.

ANADROMOUS AND RESIDENT FISH RESOURCES

ENVIRONMENTAL SETTING

As one reviews the historical background of anadromous fish stocks in the South Fork Trinity River Basin, it becomes evident that a series of impacts through time have led to the decline of salmon and steelhead trout habitat, and thus to a reduction in the numbers of fish. Such factors as catastrophic floods, natural landslides, road construction, timber harvesting, and grazing in conjunction with the commercial harvest of fish and the Indian fishery, as well as other unidentified causes, may have contributed to lowered habitat quality and population levels (MSSDP, 1985, p. 3).

The single event that most cumulatively devastated the South Fork Trinity River system was the flood event of 1964. The flood moved millions of cubic yards of soil within the basin destroying valuable spawning, holding, and rearing habitat. To this date the South Fork has not recovered from this event and fish populations remain low. With respect to fisheries this basin remains highly sensitive.

FISH SPECIES

The South Fork Trinity River is one of the most important tributaries within the Trinity River system with respect to anadromous fish production. There are seven known runs or stocks of anadromous fish which utilize the South Fork Trinity River: winter-run steelhead, spring-run (summer) steelhead, fall-run chinook, spring-run chinook, coho salmon, chum salmon, and Pacific lamprey (Haskins and Zustak, 1988, p. 5).

Steelhead Trout

Two adult races of steelhead are indigenous to the South Fork Trinity River; the spring-run (summer) steelhead and the winter-run steelhead.

Summer steelhead ascend (into the Trinity River system) in May and June and holdover in deep, cold, pools and spawn the following winter (Leidy, 1984). There are relatively few California streams that provide the cool, deep pools necessary for the survival of summer steelhead (SSMG, 1985, p. 3).

Roelofs, 1985 defines, "....essential habitat (for summer steelhead) as all stream reaches used by adult summer steelhead for extended time periods (holding times of weeks to months) and all portions of the drainage adjacent to and upstream from these reaches that are accessible to adult fish."

Summer steelhead habitat is very sensitive to disturbance. Both natural and man-caused landslides have been the major cause of habitat alteration. Adverse impacts to spawning sites, stream shade canopy, water temperature, bank stability, and pool frequency and volume have been documented (SSMG, 1985, p. 6).

Roelofs (1985) iterates, "Summer steelhead in California in nearly every case are associated with watersheds having no or minimal human impacts, primarily on public lands classified or potentially classifiable as wilderness. If the physical habitat is maintained, summer steelhead can be maintained; without the physical habitat, all other management efforts for summer steelhead are pointless. Road construction and other logging activities should be done in such a way to assure minimum impacts on summer steelhead essential habitat. Logging practices that involve minimum roading (e.g. helicopter and high lead operations) would be preferred. When roads are built, they should not penetrate the stream inner gorge (Farrington and Savina, 1977) an area within the streamside protection zone".

With respect to the project area, surveyors observed fifty-four summer steelhead (59 percent of the total) in the South Fork Trinity River below Forest Glen in the comprehensive surveys of 1979 and 1982. These fish were located between Rattlesnake Creek and Sulphur Glade Creek. Thirty-seven steelhead (41 percent) were observed above Forest Glen. Projected populations estimates for summer steelhead in the South Fork Trinity River above Hyampom Valley range between 100 to 200 fish.

The spring-run (summer) steelhead is designated as a sensitive fish specie by the USDA Forest Service in Region 5 owing to its limited habitat preferences and low population numbers. As such it cannot tolerate further degradation of its habitat or reduction of numbers. Sensitive species are not subject to legal mandates, but receive special management protection and action in order to prevent the need for placement on Federal or State threatened or endangered lists (SSMG, 1985, p.2).

In the tributaries of the Trinity River (winter-run steelhead) begin spawning migration in December and continue through April (Leidy, 1984). Winter-run steelhead migrations to the South Fork Trinity River are normally keyed to increased streamflows and cooler water temperatures as a result of early winter rains. Unlike the summer steelhead, the winter-run steelhead does not require long-term resting areas, but do utilize pools for resting during migration and for staging purposes prior to spawning. Winter-run steelhead have the widest distribution of any of the anadromous fish species in the South Fork Trinity River basin, especially in tributary streams. Due to their wide distribution, impacts from management activities (i.e. timber harvesting and road construction) could have a greater effect on winter-run steelhead than other species. No information is available as to the overall magnitude of the winter steelhead run.

Within the project area, the presence of juvenile steelhead trout has been documented only in Cave Creek, Little Bear Wallow Creek, and the Plummer Creek system. However, other streams tributary to the South Fork Trinity River provide cool, high quality waters which help to maintain tolerable water temperatures within the South Fork Trinity River.

Electrofishing within the South Fork Trinity River basin has been undertaken in select tributaries to index and assess long-term production trends in juvenile steelhead production. Selected tributaries include Big Creek (Hayfork Valley), Hayfork Creek, Rattlesnake Creek, Rusch Creek, and Salt Creek. However, owing to the remoteness of the area and limited access, electrofishing has not been undertaken in the project area streams.

Chinook Salmon

Adult chinooks enter the Klamath River estuary from the ocean in two well-defined spawning runs; one in the spring and one in late summer or early fall.

The spring-run chinook begin (migration) in late March, reach a peak in late May, and end in July. Before this century, spring-run chinook were by far the largest run in the Klamath River basin (CDWR, 1982, p.10). In tributaries of both the Trinity and Klamath Rivers spring chinook will hold (like the summer steelhead) in deep, cold, permanent pools from June to September prior to spawning (Leidy, 1984). Spring-run chinook spawn in the South Fork Trinity River from about 1.9 miles above Hyampom upstream 46 miles and in Hayfork Creek from 1.9 to 6.8 miles above its mouth (LaFaunce, 1967). No spring-run chinook were found in the lower 4.5 miles of Hayfork Creek during the comprehensive snorkeling survey of 1982.

With respect to the project area, surveyors observed 214 spring-run chinook salmon (72 percent of the total) in the South Fork Trinity River below Forest Glen in the comprehensive surveys of 1979 and 1982. These fish were located between Rattlesnake Creek and Sulphur Glade Creek. Eighty-three spring-run chinook (28 percent) were observed above Forest Glen. Projected populations estimates for spring-run chinook in the South Fork Trinity River above Hyampom Valley range between 200 to 400 fish.

The fall-run usually enters the Klamath estuary in July, peaks in August, and declines through September. In the South Fork Trinity River the spring-run chinook begin to spawn in late September, and the fall-run salmon begin in mid-October (CDWR, 1982, p.10). Fall-run chinook spawn in the lower 30 miles of the South Fork Trinity River below Hyampom and in the lower 2.7 miles of Hayfork Creek (LaFaunce, 1967).

Since 1980, the California Department of Fish and Game (CDF&G) has conducted annual fall chinook spawning surveys in the South Fork Trinity River between its confluence with the Trinity River upstream through the Hyampom Gorge. Since 1985, the fall-run chinook escapement has been estimated to range between 450 and 2,250 based on mark and recapture studies by CDF&G (Terry Mills, Personal Communication, 1988).

Coho Salmon

Coho salmon spawn in the basin, but their numbers are small (Kucas, 1983). The frequency and size of the coho salmon runs in the South Fork are not well documented, though they have been reported to migrate as far upstream as Hyampom (CDWR, 1982, p. 10). Although coho salmon were reported in Rattlesnake Creek in 1987, their presence were not confirmed by either CDF&G or Forest Service biologists.

Chum Salmon

Chum salmon are considered infrequent visitors to the South Fork Trinity River. Moyle, 1976 reports, "... chum salmon contribute little to the commercial catch in California. The few that are caught off the California coast presumably originated in streams north of the state. Most of the chum salmon found in California streams are strays...such fish generally die without spawning".

Pacific Lamprey

Pacific lamprey are found throughout the Trinity River basin. Moyle, 1976 reports, "Adults...usually move into the spawning streams between April and late July. In the Trinity River, Moffett and Smith (1950) observed some migration also occurring in August and September. Often lampreys will migrate several months before they spawn, hiding under stones and logs until fully mature".

Lamprey eggs develop into a larval form called "ammocoetes" which move into suitable areas of soft sand or mud for rearing. In three to seven years, they metamorphose into adults. Despite their predaceous habitats, (anadromous lamprey) seem to have little effect on fish populations (Moyle, 1976).

Electrofishing within the South Fork Trinity River basin has produced ammocoetes in Big Creek (Hayfork Valley), Hayfork Creek, Rattlesnake Creek, Rusch Creek, and Salt Creek. It is possible that Pacific lamprey distribution may be as extensive as that of the winter-run steelhead. Based on their presence in Rattlesnake Creek, it is assumed that Pacific lamprey use the mainstem South Fork Trinity River and select tributaries below Forest Glen for spawning and rearing.

Resident Trout

The presence of resident fish has been acknowledged in the Plummer Creek system and Little Bear Wallow Creek. In Cave Creek, resident rainbow trout were observed in the stream survey of 1973, but were not seen in the 1985 stream survey. Presently, there is no scientific method for separating rainbow trout juveniles from steelhead trout juveniles by external characteristics. In the Trinity River Basin, they share a common ancestral heritage - the Coastal Steelhead.

Generally, stream surveyors have separated the two fish stocks by stream location. In an anadromous fish stream, upstream migration by salmon and steelheed becomes negated by natural barriers i.e. geological formations or large woody debris.

Stream surveyors are therefore instructed to identify this constriction to passage as the final limit to anadromous fish distribution. Any juvenile fish found above one of these barriers is identified as a resident rainbow trout. However, there is no reason why resident rainbows can't travel downstream and mixed with steelhead juveniles. At a small size this is not evident, but a trout six inches in size or greater observed in an anadromous fish section is labelled a resident fish. As such, the designation steelhead/ rainbow trout is applied.

If damage occurs to fish habitat in a drainage containing steelhead trout and resident rainbow trout, the assumption is that resident rainbow will be impacted first because of their hierarchical location in the stream system.

HARVEST REGULATIONS

According to the 1988 California Sport Fishing Regulations, the following regulations apply to the taking of trout and salmon in the South Fork Trinity River basin:

<u>TROUT</u> - Article 7. North Coast District

Section 13.05 (c) (3) - **In the South Fork from the Hwy. 36 bridge at Forest Glen downstream to its mouth (confluence with the Trinity River)** - Open to fishing year round
<u>Daily Bag Limit</u>: Three trout [and five salmon, but no more than two salmon greater than 22 inches total length]

Section 13.05 (e) (1) - **In the South Fork upstream from the Hwy. 36 bridge at Forest Glen** - Open to fishing from the Saturday preceding Memorial Day to November 15
<u>Daily Bag Limit</u>: Five trout

Section 13.05 (e) (1) - **In tributaries to the South Fork** Open to fishing from the Saturday preceding Memorial Day to November 15 - <u>Daily Bag Limit</u>: Five trout

<u>SALMON</u> - Article 7. North Coast District

In the South Fork from the Hwy. 36 bridge at Forest Glen downstream to its mouth (confluence with the Trinity River)
Open to fishing year round

<u>Daily Bag Limit</u>: [Three trout and] five salmon, but no more than two salmon greater than 22.0 inches total length. [Section 13.05 (e) (3)].

<u>Weekly Bag Limit</u>: No more than six king salmon over 22.0 inches total length may be taken in any seven consecutive calendar days. [Section 13.86].

<u>Possession Limit</u> - No more than eight salmon of which no more than six over 22.0 inches in total length may be possessed. [Section 13.86].

Size and Species Restrictions: No person shall retain any king salmon over 22.0 inches total length in the...South Fork Trinity River commencing 43 days after the Department determines that one-third of the allowable Klamath River basin sport catch has been taken below the Hwy. 101 bridge in any year. The Department shall inform the Commission, and the public via the news media, prior to any implementation of the provisions of this subsection.

In the South Fork upstream from the Hwy. 36 bridge at Forest Glen and in tributaries to the South Fork - Open to fishing from the Saturday preceding Memorial Day to November 15

This AREA is CLOSED TO the TAKING OF SALMON, but not to the taking of trout. Limit: 5 trout

ILLEGAL FISH HARVEST

The legal harvest of spring-run chinook and summer steelhead by river sport anglers in the South Fork is considered low. However, the illegal harvest by poachers on spring-run chinook is high, but low on summer steelhead. Poaching methods include use of firearms, snagging, spearfishing, and to a lesser extent blasting. The spring-run chinook, because of its larger size, is the preferred prey species by poachers. During times of low waterflows and difficult passage conditions, the spring-run chinook is especially vulnerable. California Department of Fish and Game law enforcement officers expend a considerable amount of time during the summer patrolling the South Fork Trinity River for illegal harvest activities (Darrell Yount, Personal Communication, 1988).

FISH HABITAT

Within the South Fork Trinity River basin there are approximately 235 miles of steelhead trout habitat, 110 miles of chinook habitat, 105 miles of coho salmon habitat, and 170 miles of resident rainbow trout habitat. These estimates are based on old stream surveys, personal interviews, and an unsigned compilation of fish habitat information by the Shasta-Trinity National Forests (Kucas, 1983).

Condition of the Fish Habitat

Kucas, 1983 reports that, "Prior to the flood of December 1964, the river was characterized by scattered large, deep pools interspersed with shallow pools, riffles, and rapids. Gravel and fine sediment deposited during and after the 1964 flood destroyed most of the large pools and aggraded the streambed. Continued excessive sedimentation since the flood has delayed recovery of the stream channel. Presently, the stream contains wide, shallow riffles, and shallow pools occasionally interspersed with deeper pools. Debris slides line many parts of the river. Additionally, millions of cubic yards of sediment still remain in the lower reaches of the tributaries in the South Fork in the form of terraces or channel fill (Haskins, 1981). This material is seasonally mobilized through scour and lateral erosion. Approximately one-half of the material that was released during the 1964 flood is still located in the basin (Buer, Personal Communication)".

CH2M Hill (1985) reports, "The principal constraints to anadromous fish production in the South Fork Trinity...are (in order of importance) sedimentation, reduced water quality, reduced flows, unscreened diversions, hydroelectric developments, and migration barriers. Sedimentation of anadromous fish habitat has been a problem...due to natural instability, bank erosion and sloughing, local agricultural activities, and timber management activities. The adverse effects of natural instability and land management practices in the South Fork Trinity...were greatly accelerated by the 1964 flood. Since the flood, salmon and steelhead habitat along the South Fork Trinity River below Forest Glen (RM 55.9) has been severely degraded. The increased sediment load in the South Fork Trinity River and its tributaries resulted in sedimented or armored spawning riffles and filled-in adult holding and juvenile rearing pools. The high flows during the flood also caused stream channels in the...(South Fork Trinity River basin)...to widen and become shallower (thereby reducing fish production capability)". Natural landslides and re-entrainment of the 1964 flood deposits are the largest current sources of sediment in this basin (D. Haskins, 1981).

Within the project area, the South Fork Trinity River flows through a canyon with a moderate to low stream gradient. The habitat is characterized by a good mix of pools and riffles. Pool size varies considerably, most are less than 15 feet in diameter. However, they are generally shallow (less than 5 feet in depth) with pool bottoms covered by sand. Instream boulders are common in several areas and provide good inpool cover. Spawning gravels are common in the riffles and runs, however, they are moderately cemented as a result of the deposition of fine sediments. Most of the tributary streams in the EIS area are small, of steep gradient, and have barriers which preclude fish access. Steelhead habitat is extremely limited and is associated in tributary confluences with the South Fork Trinity River. The overall habitat condition of the South Fork Trinity River is rated a high fair (MSSDP, 1985, p.32).

Typical of the South Fork Trinity River basin water quality from tributary streams is generally considered good. However, during the summer as the water levels recede in the mainstem, water temperatures rise toward the upper tolerance limits of salmon and steelhead. Critical to maintaining cooler water temperatures in the South Fork Trinity River are the flows of cool, clean water from tributary streams.

Three major tributaries within the project area are anadromous fish streams: Cave Creek, Little Bear Wallow Creek and Plummer Creek.

Cave Creek

This is a small Class III stream tributary to the South Fork Trinity River. No juvenile fish were seen in Cave Creek during the stream survey of 1985 as compared to the 1973 survey in which steelhead/rainbow trout juveniles and adults were seen. Cave Creek is inaccessible to anadromous fish 600 feet above its confluence with the South Fork. Fish habitat is poor, limited by steep gradient, small pools, and small stream size. Bank and channel stability is fair. Bank cutting and lateral scour are common and some mass-wasting was noted. Water quality is good.

Little Bear Wallow Creek

This is a medium-sized, Class I stream tributary to the South Fork Trinity River. The lower 0.5 miles of stream is accessible to anadromous fish. Above that point, a 75 foot cascade/falls prevents further upstream passage of anadromous fish. Steelhead/rainbow juveniles were the only fish species observed during the stream survey of 1982. Fish abundance is estimated at 30 fish per 100 feet of stream. Reproduction is fair. Fish habitat is in good condition. Large pools are common with good inpool shelter. Spawning gravels are common and in good shape. Instream invertebrate productivity is good as fish food organisms are present. Channel stability and water quality is good.

Plummer Creek

A tributary to the South Fork Trinity River, this is a small perennial Class II stream below Jims Creek. The lower 2.1 miles is accessible to anadromous fish. No barriers were found until 0.25 to 0.5 miles above Jims Creek; at that point boulder fields formed numerous barriers. Steelhead/rainbow juveniles were observed during the stream survey of 1982. Winter flows may greatly increase available spawning habitat, however, a 55 to 65 foot high waterfall is located one mile above Plummer Creek's confluence with Jims Creek. Fish abundance is estimated at 20 fish per 100 feet of stream. Reproduction is good. Fish habitat is in fair condition. Medium-sized pools are common with fair inpool shelter. Instream invertebrate productivity is good as fish food organisms are present. Channel stability is fair and water quality is good. Resident rainbow trout were present in Plummer Creek.

In 1979, surveyors reported Bear Wallow Creek as Class II in the lower 2.0 miles and Class III in the upper 1.0 mile. They indicated all reaches support resident rainbow trout, but that three major log jams located in the lower reach present complete barriers to the upstream migration of anadromous salmonids. Mass wasting, slides, and bank slippage is common. Heavy logging, road crossings, and a complete lack of streamside buffer strips on private lands in the middle reach, have compounded stability problems. Considerable logging debris was distributed throughout the stream channel.

In 1980, stream surveyors classified Jims Creek as a Class II stream providing limited fish habitat for resident rainbow trout and steelhead juveniles. The stream gradient in the upper and lower reaches surveyed was approximately 7 percent while the middle reach was steep (22 percent).

In 1980, surveyors reported that anadromous fish passage into Naufus Creek is prevented by a 50 foot high waterfall. However, in 1974 surveyors did find a few resident rainbow trout in Naufus Creek, but reported spawning areas were few and in poor condition, being compacted and silt covered.

Effects of Prior Timber Harvest and Fires of 1987

Due to the quality of past logging practices and intensive harvest activities, some watersheds in the Hayfork burned areas have undergone adverse cumulative watershed effects. Cumulative effects to fisheries include loss of pools and cover, impaction and cementation of spawning gravels, loss of rearing habitat, and loss of benthic invertebrate production [fish food organisms] due to the filling of interstitial spaces [between rocks] within riffles. The potential for cumulative effects to the fisheries becomes greater as stream size increases. This is significant because fisheries values also increase with stream size, hence potential adverse effects to the fish habitat are directly related to fisheries values (Haskins and Zustak, 1988, p. 7).

Direct effects of the fire upon the fisheries resource come under two broad categories: immediate impacts to fish populations, and impacts to the habitat. Direct fire impacts to the fish habitat were much more dramatic and of greater consequence than the immediate impacts to the aquatic macrobiota. Direct consequences of the fire to the fish habitat would include loss of channel stability, loss of rearing habitat, and increased sediment yield. The loss of channel stability occurred when the large stable woody debris was burned. The destruction of the large woody debris is also tied to the loss of rearing habitat as woody debris is an important component of pool structure and cover. Without the large woody debris, pools fill in with sediments as control points are eliminated. Loss of woody channel debris and the destruction of the overhanging vegetation also means that fish have fewer places to hide. This results in the liklihood of increased predation (Haskins and Zustak, 1988, pgs. 9 & 10).

The increase in sediment yield to a stream is also a consequence of fire [as natural protective cover is removed from the landscape thereby accelerating erosion]. This is not a problem if the stream is capable of transporting the additional sediment. The problem lies in the fact that if the sediment becomes entrapped in the system, it can result in pool filling, impaction of spawning gravels, and the loss of benthic invertebrate production. These all have the effect of reducing available fish habitat and ultimately fish production (Haskins and Zustak, 1988, p. 10).

The effects of the 1987 fires on streams within the project area are discussed in the "HYDROLOGY" section. In summary, riparian areas were burned in the smaller streamcourses tributary to the upper portions of Cave Creek and Kingfisher Creek. However, neither the mainstem of Cave Creek nor that of Kingfisher Creek displayed a loss of existing log and woody debris control structures. Natural (pre-fire) instream structures, straw bale check dams installed during emergency burn area rehabilitation efforts, and newly fallen, fire-killed debris are presently serving to trap sediments and minimize delivery of unwanted sediments to the South Fork Trinity River. Owing to a relatively mild 1987-1988 winter with resulting drought conditions, sediment delivery was limited to early winter storms. As an added safety measure additional straw bale check dams were constructed in March, 1988.

Fish Habitat Improvement

"Tributaries are primary spawning and rearing areas for steelhead and possibly silver salmon, and influence ...(downstream areas)... by their contribution of cool water, important gravel for spawning and their sediment input. Therefore any attempt to improve the anadromous fisheries of the (Trinity River) basin must seek to control sediment inflow from tributaries, reduce water temperature of the tributaries...as well as improve spawning, rearing and holding capacity in the tributaries themselves" (VTN, 1979, p. II-71/72).

In August 1981, a Model Steelhead Stream Demonstration Project Charter, designed to protect and enhance the habitat and runs of steelhead in the South Fork Trinity River, was signed by representatives of the USDA Forest Service, California Department of Fish and Game, and California Trout, Inc. (MSSDP, 1985, p. 7).

The project is designed to utilize and demonstrate best management practices and technology in fishery and resource management with the intent to rehabilitate and improve the runs of steelhead in the South Fork over a 20-30 year period while maintaining other resource outputs, such as timber harvest (MSSDP, 1985, p. 7).

It is the intent of the project to "demonstrate that cooperative multiple resource management can provide for the protection and/or enhancement of the steelhead trout resource in the basin without reducing other resource outputs" (MSSDP, 1985, p. 3).

To date, fish habitat improvement and/or watershed restoration efforts have been undertaken in select subwatersheds on the Shasta-Trinity National Forests within the South Fork Trinity River basin based on accessibility and previously identified opportunities. However, in 1987 the Model Steelhead Program committee reprioritized the subwatersheds according to those either having a current limiting factor analysis or the potential to generate best returns for the money invested. The following table lists subwatersheds with previous actions and the newly prioritized subwatersheds for future analysis and development:

SUBWATERSHEDS W/PARTIAL IMPROVEMENTS	NEWLY PRIORITIZED SUBWATERSHEDS
#21 - Butter Creek	#29 - Tule Creek
#23 - Rattlesnake Creek	#23 - Rattlesnake Creek
#24 - Upper Mainstem South Fork	#30 - Salt Creek
#28 - Corral Creek	#19 - Grouse Creek
#29 - Tule Creek	#32 - Big Creek
#32 - Big Creek	#35 - Upper Hayfork and Tribs.
#35 - Upper Hayfork Creek	#24 - Upper South Fork Trinity

No fish habitat improvements are currently being planned for either the Middle Mainstem South Fork Trinity (#20), Upper Mainstem South Fork Trinity (#24), or Plummer Creek (#22) until limiting factor analyses (habitat typing) is completed.

Presently, four fish habitat improvement projects have been identified in the Plummer Creek system. However, the Plummer Creek system needs a limiting factor analysis and each project proposal needs further verification:

52-00110 - Bear Wallow Barrier Removal. Need to modify a 4-foot bedrock falls at the mouth which is a partial barrier. Need to remove 3 log jams which are complete barriers. Barrier removal will provide anadromous fish access to an additional 2 miles of stream. Removal of the rock barrier at the mouth would be accomplished by the use of explosives. The debris jams will require removal by hand. Access to the site is via Road 1N17 and then by foot for 1.5 to 2.0 miles to the work site.

52-00111 - Bear Wallow Fallen Bridge Removal. An old log bridge has fallen into the channel resulting in a log jam and bank-cutting. Need to remove the logs; stabilize and revegetate the cut-banks; and rip and seed the road approaches to the bridge. An intensive on-site investigation is required to determine the extent of damage and stabilization measures to be employed. Access to the site is good via Road 1N17.

52-00114 - Plummer Creek Watershed Rehabilitation. Erosion and mass-wasting are contributing significant amounts of sediment to Plummer Creek. Stabilization of slides and failing banks as well as erosion control measures are needed. The project area will cover the lower 3 miles of the stream. An intensive on-site investigation is required to determine restoration specifics. Access is poor and is limited to hiking over steep terrain.

52-00115 - Plummer Creek Barrier Removal. Need to remove two large debris jams. These jams are not barriers, but do increase channel side-cutting at high flows and are potential future barriers. The debris jams are located approximately 200 yards above the confluence of Jims Creek and upstream 1/4 mile. The debris jams will require removal by hand. Access is poor and is limited to hiking over steep terrain.

Two fish habitat improvement projects have been identified in Little Bear Wallow Creek. Complete or partial removal of barrier B-2 is recommended. Barrier B-2 is a 6-foot debris jam with an estimated 10 cubic yards of sediment in storage (upstream length:1000 ft.). Although steelhead fry were observed above B-2, the barrier does present a formidable obstacle at low flows. The proposed project must consider the slow release of the stored sediment to avoid direct impacts to downstream fish habitat. Removal of barrier B-9 would benefit the resident trout fishery. B-9 is a 3-foot debris jam bound by two or more 20 inch diameter logs and smaller woody debris (upstream length:4500 ft.).

No fish habitat improvement projects have been identified in Cave Creek.

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